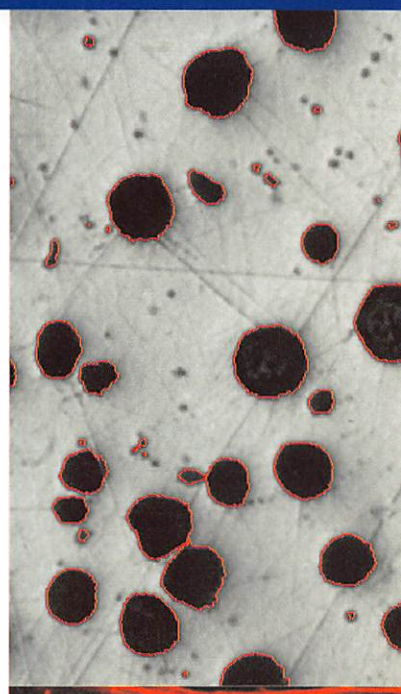
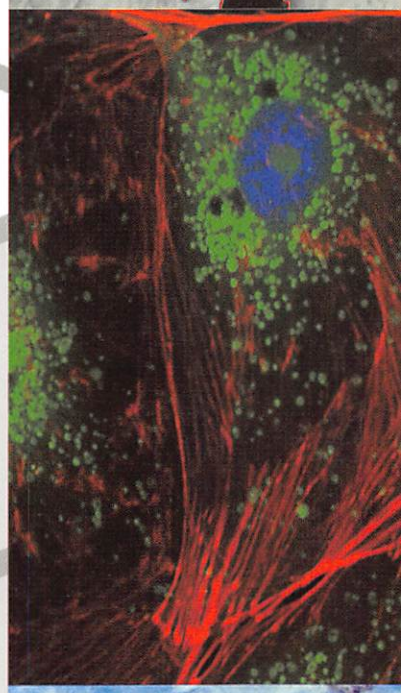
iSolution DT
i-Solution™
iSolution Chameleon
iSolution Lite

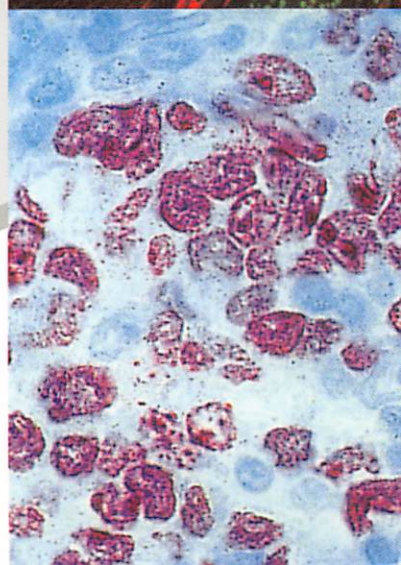
USER GUIDE FOR WINDOWS

Measuring and Analyzing with Ease

Image processing, measurement and analysis software.
Features a 32-bit / 64-bit COM-based application for MS Windows which is easily expanded through plug-in components.







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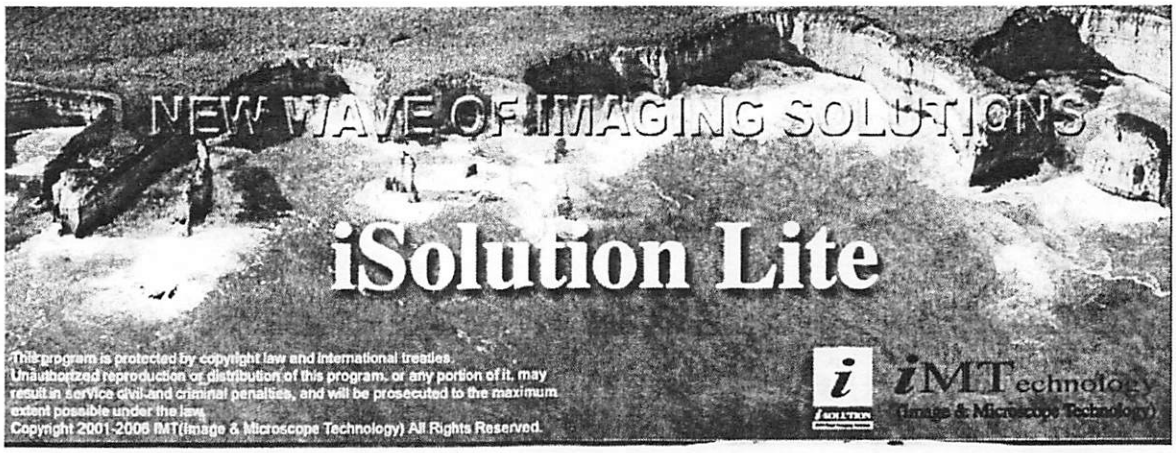
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iSolution Lite
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User's Guide

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Introduction

Welcome to IMT iSolution Lite, the image-processing program designed to capture, modify, enhance, and measure digital images. IMT iSolution Lite is a 32-bit/64-bit application for Windows 98SE/ME/2000/XP/VISTA. We hope that our program will help you to solve a wide variety of image-analysis problems. Please take the time to read through this manual so that you can take full advantage of IMT iSolution Lite's many features.

Note: This user guide assumes you have a working knowledge of your computer and its operating conventions, including how to use a mouse and standard menus and commands. It also assumes you know how to open, save, and close files. For help with any of these techniques, please see your Windows documentation.

This section describes the program's general features and functions as well as the tasks that the program can help you perform.

Program general features and functions

The program allows you to:

- load and save images in several graphical formats:
  - bmp
  - jpg
  - tiff
  - pcx
  - gif
  - tga
- load and save image sequences in the formats below, if DirectX 7.0 or higher is installed:
  - avi
  - mpg
  - mov
  - img, rpt (the formats from the IMT program)
- acquire gray-scale and color images directly through a TWAIN-compliant device or other image device that the program controls, open images from files, and paste images from the clipboard
- enhance image quality
- type comments, draw graphics, and exchange graphics between images
- manually measure linear and angular values
- export measurement results to MS Excel for further processing
- print images and results of analysis

Main Tasks

The main task of the program is to help a user identify objects on images and to measure their parameters.

The following steps will help you carry out this task successfully:

I. Capture an image or open the image or image sequence.

II. Enhance the image.

III. Measure the objects.

IV. Create and print a report.

Chapter 1 - Getting Started

Overview

This chapter describes the organization of this manual and introduces you to the program. It also covers some basics about using the program, including:

- Using this manual
- System requirements
- Software package
- Installing the program
- Starting the program
- Uninstalling the program
- Getting help

Using this manual

This program User's Manual is designed to provide you with instructions on using the program to measure and manipulate color and gray scale images. The chapters of the manual cover the following topics:

- **Introduction** describes what the program is and its features.
- **Chapter 1** describes the system requirements, how to install and uninstall the program, and how to get help.
- **Chapter 2** contains a short overview of image processing.
- **Chapter 3** describes the program layout, setting options, terms and notions, and working with documents.
- **Chapter 4** describes general settings, printer settings, and how to open, save, and print image files.
- **Chapter 5** describes how to manipulate images (cut, copy, paste, etc.), transform images, and annotate the image.
- **Chapter 6** describes how to acquire images, to measure the image on preview windows, and to set the overlay mask.
- **Chapter 7** describes how to manipulate, turn, divide, and merge images, and how to make video files.
- **Chapter 8** describes various ways to control and enhance the quality of images.
- **Chapter 9** describes how to define image objects, measure image objects, view and process data.
- **Chapter 10** describes how to create reports, print images, and measure results.
- **Chapter 11** describes all of the menu commands.
- **Appendix A** describes the *Guardant electronic key* and how to use it.

Special conventions

Below are some special conventions used to present information in this manual. This special information can help you to quickly solve possible problems while working with this program.

Important notes

Important notes and notices are marked like this:

Note: An important note.

Tips

Tips that can help you work with the program more efficiently are marked like this:

Tip: Useful tip.

Terms and Notions

Terms and notions used in this manual are marked as in this example:

Image is a picture in a digital form, suitable for processing by a computer. It consists of figures that are the values of color brightness.

Referencing Commands

The manual refers to commands in the following way:

Menu>Sub-menu>Command

For example, to show the **Filter** dialog from the **Process** menu, the manual would describe the location of the command as: **Process>Filter...**

System Requirements

- PC with a Pentium-class processor; Pentium 300MMX or higher recommended
- Microsoft Windows 98SE/ME/2000/XP/VISTA operating system
- 32 MB of RAM or more (128 MB recommended)
- 15 MB hard-disk space
- CD-ROM drive
- VGA or higher-resolution monitor; Super VGA recommended
- Microsoft Mouse or compatible pointing device
- USB- or LPT-port for hardware key (depends on delivery).

Software package

The software package includes the program software and documentation:

- The program software CD

- The program User's Guide
- USB- or LPT-port hardware key (drivers are included).

The program software CD contains everything you need to install and run the program:

- Sample image files.

Installing the program

The program must be installed from within Windows. To install the program:

1. Place the program Setup CD into the appropriate CD drive.
2. Run iSolution Lite.exe in the program Setup CD and follow the instructions. If you need to, you can install "CaptureDrivers.exe," which is a group of drivers for imaging devices that are controlled by their own programs.
3. Connect the "Dongle (Electronic key)" to a printer port or USB port of your computer. Then Windows will find it by itself.

Starting the program

After the program is installed it is automatically included in the Windows programs list. To run the program:

1. Click the **Start** button.
2. Select the **Programs** item.
3. Select the IMT > iSolution Lite item from the **Programs** list.
4. Run the program.

Uninstalling the program

Use the **Add/Remove Programs** in the **Control Panel** program group or **Uninstall or change a program** in the **Computer** (depending on Windows) group to uninstall the program. You must use it to remove the program completely from your system..

Getting Technical Support

The services of IMT Technical Support are available to registered customers. Customers may call Technical Support for help using IMT products or for installation help for one of the supported hardware environments.

To reach Technical Support, see the IMT home page on the World Wide Web at

http://www.imt-digital.com/ or contact us:

#17-5989 Walter Gage Rd, Vancouver, BC, Canada

Postal code: V6T 0A8

Tel: (604) 676-1727 Fax: (604) 221-7792

Email: mikeimt@unitel.co.kr

Chapter 2 - Image Processing

This chapter is a brief introduction to the basics of image processing, including:

- What is image processing
- Image Digitization
- Pixel Depth
- Color & color models, converting between different color models
- Image Enhancement
- Measuring and Counting

What is image processing

Visual representation of an object or a group of objects can be considered an image. *Image processing* is used to change the information within an image. To perform specific digital image processing, a computer is used.

To do this, the image must be converted into numeric form. This process is known as *Image Digitization.*

Images and Image Digitization

Image is a numeric form of picture, or bitmap. It is a result of a digitization process that divides a picture into very small *picture elements*, or *pixels*, which are often 1/300th of an inch square or less. In the computer, the image is represented by a two-dimensional array (or digital grid) of *pixels.*

Pixel is the smallest picture element that describes the color and brightness of a single point of the picture. Each pixel is identified by its position in the bitmap and is referenced from the upper-left position of the bitmap.

The quality of the digital image is determined by the *resolution* specified during digitization.

Resolution is a ratio of the number of picture points to a unit of the picture area. Usually resolution is defined in *dpi* (dot per inch). Desired quality (and thus resolution) and original picture size defines pixel quantity, and thereby the bitmap dimension. During digitization each pixel in the image is individually sampled, and its brightness is measured and quantified. This measurement result is a value for the pixel, usually an integer that represents the brightness or darkness of the image at that point. This value is stored in the corresponding pixel of the computer's image bitmap. When the image is digitized, the width and height of the bitmap are chosen and fixed. Together, the bitmap pixel width and height are known as its *spatial resolution.*

Pixel Depth

Each pixel value is a number. In a computer a pixel is represented by an 8-, 16-, 24- or 48-bit unsigned integer. The number of bits depends on the number of colors an image has.

Pixel values for an image that contains only black and white colors can be represented by a

single bit: 0=black, 1=white.

In order to represent all the possible colors—approximately 16.7 million that might be found in a True Color image—a pixel must be at least a 24- bit unsigned integer.

Pixel Depth, or bits-per-pixel (BP), is the number of bits used to represent the pixel values in an image. The requisite value of Pixel Depth depends on the image and its quality. Pixel Depth can also be called *Color Depth*.

Most images supports more than one level of bits-per-pixel, and therefore more than one level of color. The more information is recorded for each pixel, the more shades and hues a file can contain. The following table lists all of the bits-per-pixel ratios in the image that the program supports, and shows the corresponding maximum number of colors.

Bits-Per-Pixel	Maximum Number of Colors
1	2
4	16
8	256
16	32,768 or 65,536 (depends on format)
24	16,777,216
32	16,777,216
48	281,474,976,710,656

Pixel Depth of an image gives us the number of unique colors that can be contained within the image. But it does not tell us what colors are actually contained within the image. Pixel Depth plus one of several conventions determine color interpretation, which we call the *Color Model*.

Color and Color Models

How can we describe and process colors? Natural colors are compound and can possess millions of tints which the human eye cannot even differentiate. For example, a black-and-white image can be represented by only a single bit: 0=black, 1=white. Color ones may take 24 bits. That means more than 16 million colors. Fortunately, most color tints consist of different combinations of basic colors. That allows us to describe color mathematically and create Color Models.

Color Model is a mathematical model describing color based on several components. A Color Model enables us to interpret a pixel value and define what color and brightness the point of the image described by this pixel has.

There are three primary colors of light: **Red**, **Green** and **Blue**. All other colors are represented by a mix of different proportions of these three primary colors.

These primary colors can be called **color channels**.

Color Depth is the number of bits used to represent the pixel's color component values in an image. Pixel Depth is equal to **Color Depth Red + Color Depth Green + Color Depth Blue.** For example, for a 24-bit color image the Color Depth is 8, but for 16-bit gray image the Color Depth is 16.

All images can be subdivided into two main classes:

- Black-and-white, where all the image colors are shades of gray, from black to white. All the possible colors can be described by a *Gray Model.*
- Color, where all possible colors can be described by RGB, HSB, YUV, and other models.

By using color models we can describe color tints.

Gray Model

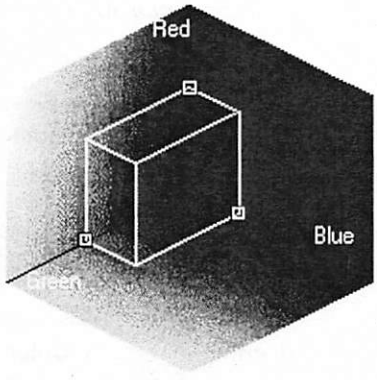
A *Gray Model* can be described as a scale ranging from completely black to completely white (all colors are shown only as shades of gray). This level of grayness or brightness is called **grayscale.** If, in the Gray Model, one pixel is stored by 8 bits (1 byte), a pixel with a value of 0 will be completely black, and a pixel with a value of 255 will be completely white (in this case Pixel Depth is 8 BPP). That means 256 levels of gray—at least 56 levels more than a human eye can distinguish.

A Gray Model with a Pixel Depth equal 16 BPP uses 16 bits to store a pixel and provides 65,536 levels of gray.

This model needs only one *color channel* to represent a grayscale image.

RGB Model

RGB means "Red, Green and Blue," the three primary colors of light. If you mix different levels of each primary color in definite proportions, you will get any desired color. In a True Color image (Pixel Depth is 24 BPP), each pixel contains a 24-bit value, 8 bits per one color. These brightness values represent levels within a 256-level scale, from 0 to 255. The first sample, the *Red*, ranges from 0 (black) to 255 (brightest red). The *Green* sample is the level of green (0-255), and the *Blue* sample is the one of blue (0-255). Various combinations of the Red, Green and Blue values allow us to get 2^{24} (over 16 million) colors.



Equal levels of Red, Green and Blue always generate a level of gray.

This model has three *color channels.*

In the case that the image Pixel Depth is 48 BPP, each color component will have a range from 0 to 65,535. It allows you to work with a wide range of digital cameras and scanners without loss of any information.

YUV Model

In this model and RGB signal is converted to a single luminance signal (Y). You can use the following formula to get the best conversion result:

$$Y = 0.299\ R + 0.587\ G + 0.114\ B,$$

where R, G, and B stand for the brightness of the respective color channels and the coefficients express physiological qualities of human vision.

U and V stand for color signals:

$$U = B - Y,\ V = R - Y$$

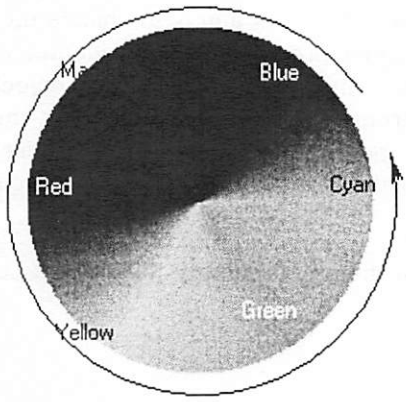
The three components described above are used in YUV model to express color.

This model has three *color channels*.

HSB Model

The *HSB* (Hue, Saturation, and Brightness) color model describes three fundamental characteristics of color:

- Hue is the color reflected from or transmitted through an object. It is specified by a position on the standard color wheel given as an angular displacement ranging from 0 to 360 degrees. In common use, hue is identified by the name of the color such as red, orange, or green.



- Saturation (percentage of white in a color) is the strength or purity of a color. Saturation represents the amount of white in proportion to the hue, measured as a percentage from 0% (white) to 100% (fully saturated). Colors with the maximal saturation (100%) are placed at the edge of the circle. By decreasing saturation we make the color lighter, as if white color was added. Every color with the minimal saturation (0%) becomes white.

- Brightness is the relative lightness or darkness of a color, usually measured as a percentage from 0% (black) to 100% (white). By adjusting brightness we can add black color to the spectral hue. Adding black and white, we create colors.

Complementary colors are placed opposite each other on the color circle, and every color is placed between the colors it was made of. For example, blue and red together create magenta. To get the increased intensity of a color we need to decrease the intensity of its complementary color. For example, to modify the overall color towards green tints, we need to decrease the content of red.

This model has three *color channels*.

Program Specialty

This program supports Gray, RGB, HSB and YUV color models. It also supports the following values for Pixel Depth:

- 8, 12, 16 – for Gray Scale images
- 24, 32, 48 – for color images

Depending on the chosen Pixel Depth, pixels are represented by 8-, 12-, 16-, 24-, 32-, or 48-bit unsigned integers.

Note: An image with 16 bits per color channel can be saved only in the native file format (*.img) and tif.

You will find the description of various file formats in Chapter 4 - Working with images.

Converting between different color models

The program allows you to convert images from one color model to another. During this operation, the L*A*B color model is used as an intermediate format. It uses 16 bit values to provide lossless converting.

Note: When decreasing Pixel Depth or converting a color image to a grayscale image you can loose information, which will be impossible to restore later.

Image Enhancement

One of the main tasks of image processing is *Image Enhancement.* Its aim is to change the image so that it will be possible to identify the objects on it most precisely. Object identification is usually provided by binarization, or *thresholding*, which divides an image into objects and background. The more the objects differ from the background in brightness and color, the more exactly they can be thresholded. That is what image processing investigates. There is no general solution to this task for all kinds of images, so this problem is solved empirically for each separate image.

There are several methods of image enhancement. One of them is to modify the intensity of each pixel of an image.

Intensity modifying

The first way to enhance an image is to change the way intensity values are interpreted. For example, if your image was very dark overall, you could boost all the values by a certain amount. You might boost all values by 20 points, or flatten a range of intensities to a single value (e.g., set all intensities from 75 through 127 to the same value of 150).

The following intensity manipulation tools are described here:

- Brightness
- Contrast
- Gamma
- Histogram
- Thresholding

Brightness

Brightness (or **intensity**) describes the overall amount of light in an image.

For a digital image, the brightness of each pixel and the color model of the image are determined by the pixel values.

For example:

- For a **grayscale** image, the brightness of a pixel is the pixel value.
- For an HSB image, the brightness of a pixel is the B component.

- For an RGB image, the brightness of a pixel is expressed by the formula: 0.3*R+0.59*G+0.11*B.

When you increase brightness you increase the value of every pixel in the image, moving each pixel closer to the intensity upper limit (for grayscale 8 BPP image this value is 255, or white). When you decrease brightness you reduce the value in each pixel, moving it closer to the intensity lower limit (for grayscale 8 BPP image this value is 0, or black). To the human eye, increasing or decreasing the image brightness looks like decolorizing or darkening of the image, respectively.

For more details about modification of image brightness and how to do it, see Chapter 4 - Working with images.

Contrast

Contrast denotes the degree of difference between the brightest and darkest components in an image, i.e. the width of the image's brightness range.

An image with good contrast is composed of a wide range of brightness values from black to white. An image with poor contrast contains only harsh black and white transitions, or contains pixel-brightness values within a narrow range.

The amount of the intensity scale used by an image is called its **dynamic range.**

Thus we can tell that an image with good contrast will have a good dynamic range.
Modification of image contrast is modification of image dynamic range correspondingly. In other words, on modification of image contrast each pixel value is scaled by a contrast value, which serves to redistribute the intensities over a wider or narrower range. Increasing the contrast spreads the pixel values across a wider range, while decreasing contrast squeezes the values into a narrower range.

You will learn how to modify image contrast in Chapter 4 - Working with images.

Gamma

Gamma correction is a specialized form of contrast enhancement. It is designed to enhance contrast in very dark or very light areas of an image by changing the midtone values, particularly those at the low end, without affecting the highlight and shadow points.

Gamma is a parameter of the *gamma correction* function. When you reduce gamma value the image gets darker and the contrast of light image details is increased. When you increase gamma value the image gets lighter and the contrast of dark image details is increased.

Gamma correction can be used to improve the appearance of an image, or to compensate for differences in the way different input and output devices respond to an image.

You will learn how to use Gamma Correction in Chapter 4 - Working with images.

Histogram

A **Histogram** (or **Intensity Histogram**) of an image is the distribution of intensities of individual pixels. Usually a histogram is represented in a graphic form as a plot, where the X-axis represents the intensity scale, and the Y-axis measures the number of pixels in the image possessing that value.

Here is an example of an Intensity Histogram:

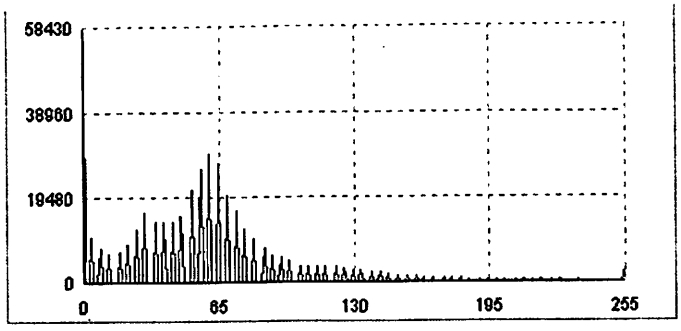


Figure 2.1. An example of a Histogram.

Histograms measure and illustrate in graphic form brightness and contrast characteristics of an image. Histogram data can be created and viewed for data gathering and analysis (discussed in more details in Chapter 4 – Working with Images), or can be manipulated for image enhancement.

When you are working with grayscale 8 BPP images, the X-axis represents gray values from 0 to 255. For grayscale 16 BPP images, the X-axis will represent the intensity range from 0 to 65,535. When working with color images, you can choose to measure either the combined image luminosity or its separate color channels (e.g., Red or Green or Blue, Hue or Saturation or Brightness...).

The Histogram allows you to estimate quickly what kind of brightness or contrast deficiencies exist in an image. **Figures 2.2.x** show histograms for images with low contrast. You may see that histograms are clustered around a very narrow portion of the color range. The position of the cluster will indicate whether the image is too dark (see **Figure 2.2.a**), too light (see **Figure 2.2.c**), or simply too gray (see **Figures 2.2.b**).

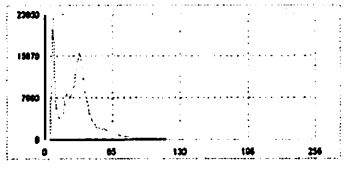


Figure 2.2.a. Dark.

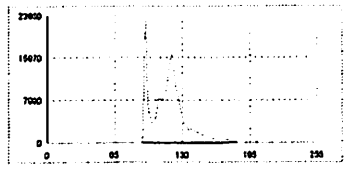


Figure 2.2.b. Gray.

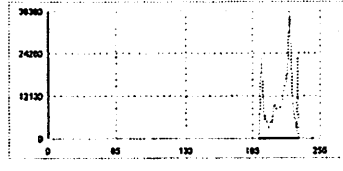


Figure 2.2.c. Light.

Brightness, contrast and gamma adjustments modify the shape of a histogram as follows:

- Contrast operations affect the width of the histogram—compressing it when it is decreased, and stretching it when it is increased.
- Brightness operation affects the X-axis position of the histogram shape (intensity scale).
- Gamma correction operation affects the width, the X-axis position, and the shape of the histogram. A decrease in gamma brings out features in the lighter area of the image by stretching the histogram in the upper region. An increase in gamma stretches the lower values, providing increased contrast in the darker areas.

For more details about image histograms, see Chapter 4 – Working with Images

Spatial Filtering

If you want the objects of interest in the image to be thresholded well, it is necessary that the image is "good", i.e., image areas occupied by the objects of interest must differ from the other part of the image on intensity.

Unfortunately ideal images are a rare thing in real life. Very often images contain areas in which

the intensity changes too quickly or too little, or contains areas of equal intensity with different colors and other defects. Frequently people clearly see objects on the image but the program can not distinguish them from the background, or does it poorly.

Filtering operations produce their effect by modifying a pixel's value (intensity) based upon the values of the pixels that surround it. This small region is called *pixel neighborhood.*

Neighborhood is a square region of image pixels (typically 3x3, 5x5 or 7x7 in size) that surrounds the specified pixel.

Filtering operations are used to even out or remove the image background, to identify the object edges, to increase image sharpness, or to blur it.

Filtering is an operation that modifies the value for all pixels of the image based upon the values of the pixels that surround it (pixel neighborhood).

All filters are divided into two categories:

- convolution (linear) filters,
- non-convolution (nonlinear) filters.
- edge filters
- special filters

Convolution filters

A convolution (or enhancement) filter has a *kernel.* A filter's kernel is a matrix of filtering coefficients (integer values). The size of a kernel defines the neighborhood size that the filter works with. Convolution filters process each pixel neighborhood by multiplying the values within a neighborhood by the filter's kernel. The results of this multiplication are summed and divided by the sum of the filter kernel. The result replaces the center pixel in the neighborhood of this pixel.

Usually this group contains filters to equalize the image histogram, perform image blur or sharpening, and subtract image background.

Non-Convolution filters

Non-convolution (or Morphological) filters also work with the pixel neighborhood, but do not have a kernel. These filters work only with data in the neighborhood itself. Applying to each neighborhood either a statistical method or a mathematic formula gives a value that replaces the center pixel in the neighborhood of this pixel.

You can find more details about image filtering in Chapter 4 – Working with Images.

Chapter 3 - Program Basics

Overview of Program Basics

This chapter reviews some basic parts of the program's user interface, including:

- The program layout
- Options and settings
- Working with documents
- Working with commands
- The program menu structure

Program layout

The first thing you'll see when you run the program is the application's Main window. Initially this window is relatively empty, as you can see in **Figure 3.2**, but once you start working, it will contain one or more "child" windows displaying images, measurements, reports, etc.

Here is an example of the Main window containing several child windows:

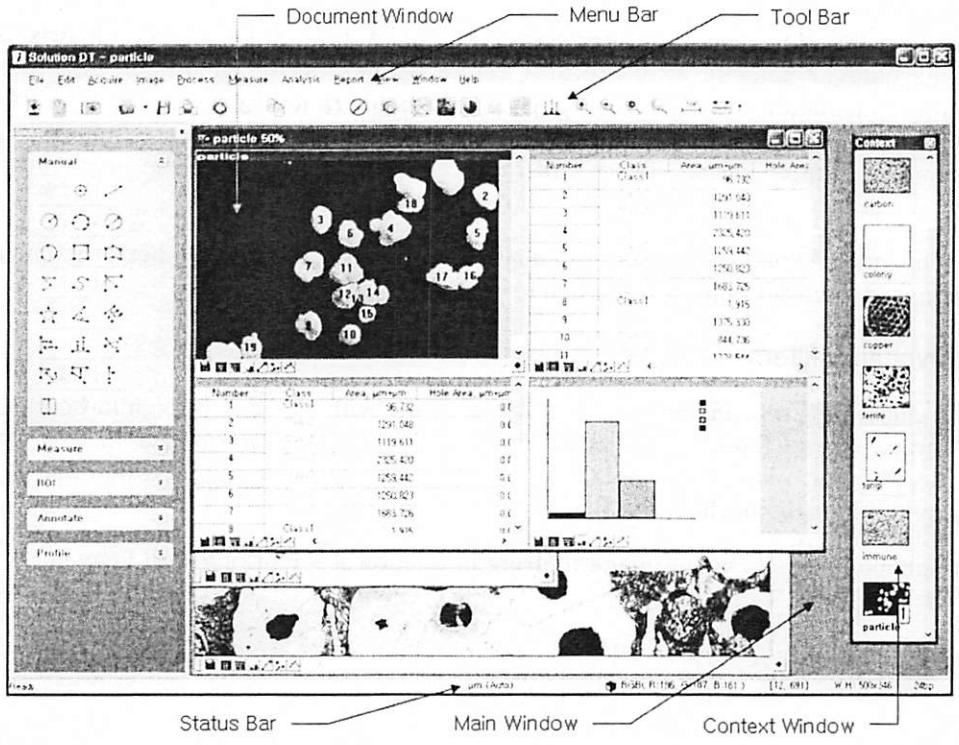


Figure 3.1. program layout example.

Main window

The **Main window** is the main window of the program. It is shown on **Figure 3.2.** It contains a **Menu Bar, Toolbars,** and **Status Bar.** The Main window can have "child" windows inside that display the contents of **Documents.** These are called **Document windows.** Upon closing the Main window, the program finishes its work. In the same figure, on the right, inside the Main window you will find the Context window, which is described below.

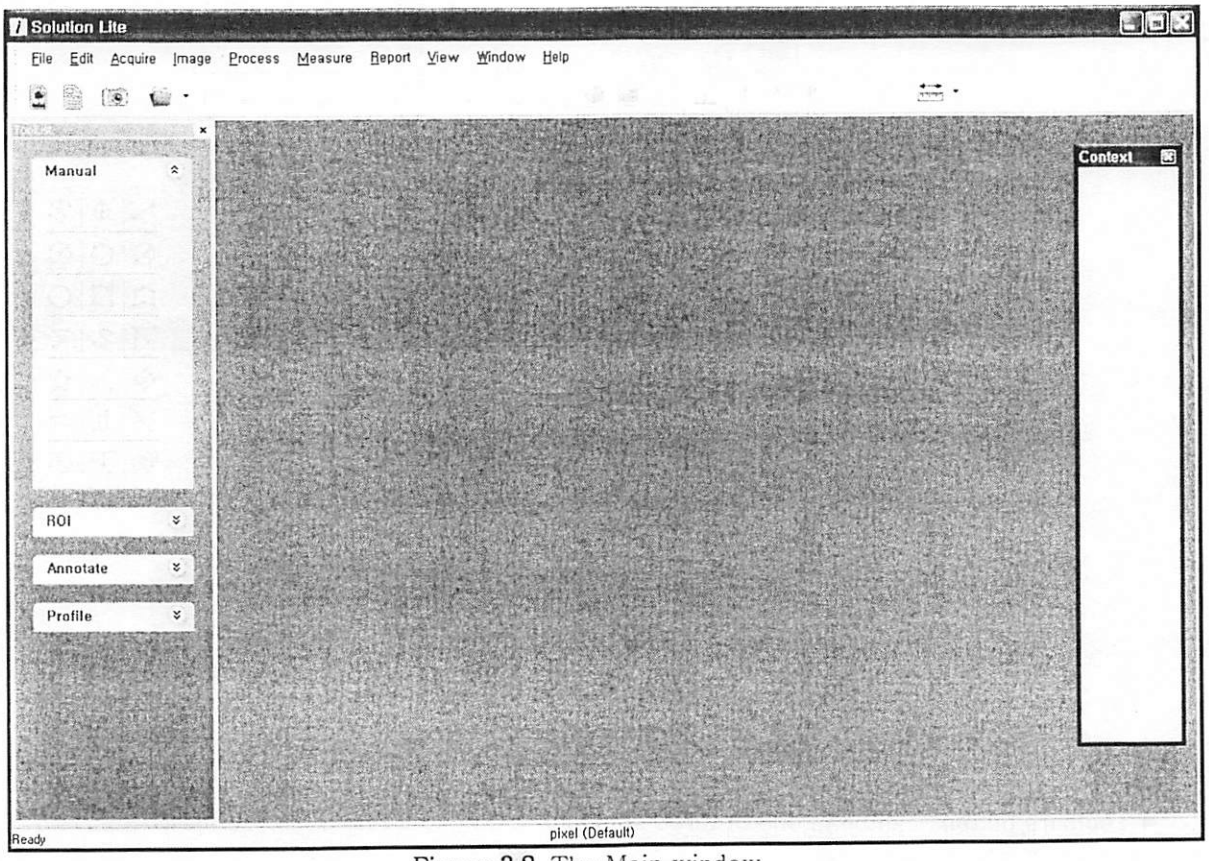


Figure 3.2. The Main window.

Toolbars

A **Toolbar** is a set of buttons that represent the program tools (**Figure 3.3**). Press a toolbar button to start the needed command. There are eight toolbars in the program. They are the **Manual, Measure, ROI, Annotate, Profile, Report, Sequence,** and **Standard** Toolbars. The program toolbars look and behave like the ones in MS Internet Explorer, as follows:

- You can find all the toolbars at the top of the Main window. If they are partially overlapped, a "chevron" appears on a toolbar. Click on it, and you will find the latent part of the toolbar (**Figure 3.3**).

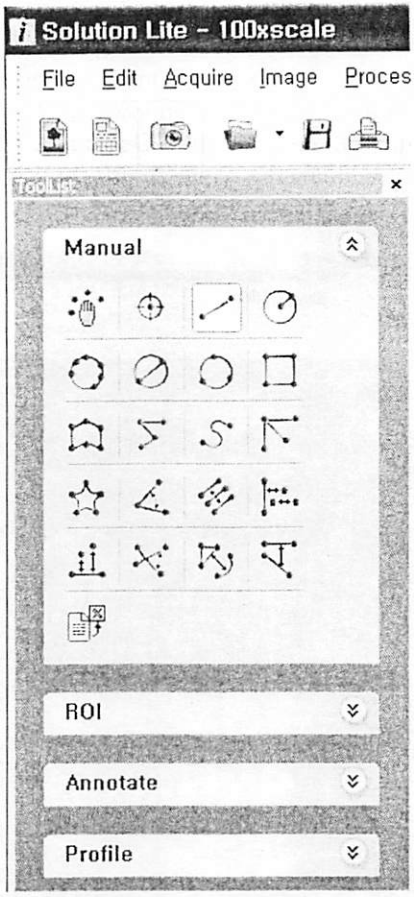


Figure 3.3. Toolbar's partial covering.

- They can be moved close to the top edge of the Main window.
- Toolbars buttons can be in one of three states:
  - Normal – the command is allowed, i.e. it can be performed. In this case a black-and-white picture is displayed on the button (see Figure 3.4);
  - Hot – the command is allowed. The mouse cursor is on the button, and a color picture is shown on it (see Figure 3.4);
  - Disabled – the command is forbidden, i.e. it cannot be performed. In this case a disabled (gray) picture is displayed on the button (see Figure 3.4).

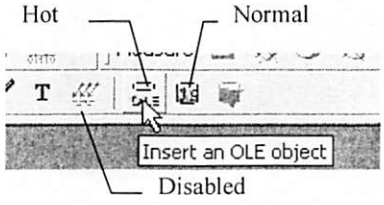


Figure 3.4. The Toolbar's button states.

- All tools except Standard can be displayed or be hidden. The Standard toolbar is always displayed. Click the right mouse button in the toolbar area at the top of the Main window to call the Toolbar's Context Menu. Then choose the toolbar name that you want to display or hide (see Figure 3.5).

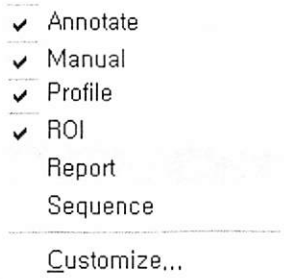


Figure 3.5. The Toolbar's context menu.

- You may customize all the toolbars to include one or all of the tools associated with that particular bar. To do it you need to display Toolbar's Context Menu and select the **Customize...** tool. The Customize Toolbar dialog will be displayed (see **Figure 3.6**). The Customize Toolbar dialog allows you to display or hide the text labels of the toolbar buttons and to choose the button picture size (small or large). The default size of icons is large.

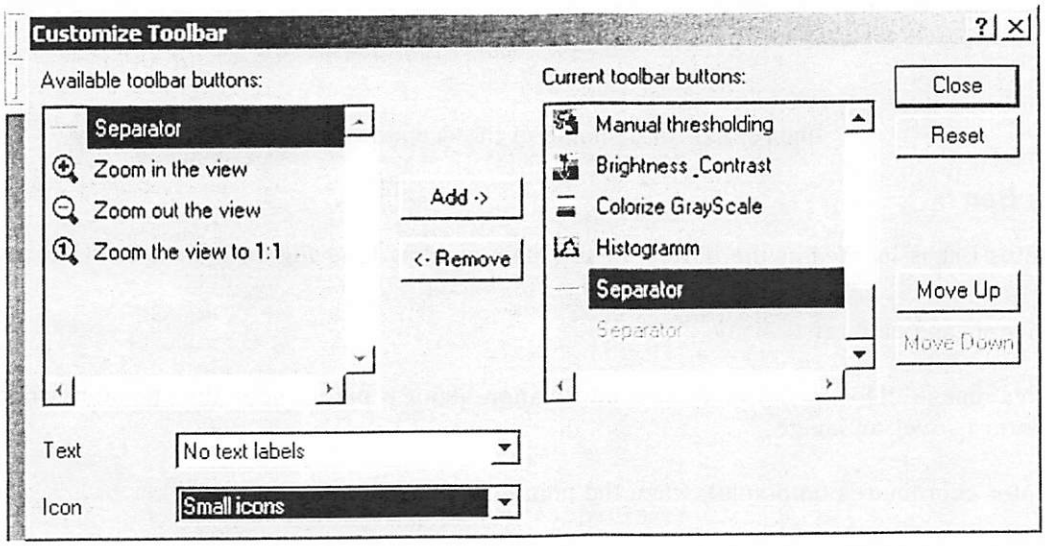


Figure 3.6. The Toolbar's Customize dialog.

Some toolbar buttons have an additional dropdown menu for fast access to often-used features. This menu appears by pressing the arrow on the right side of the toolbar button. For example, in the **File➢Open...** command the dropdown menu contains a list of recently opened files.

Menu Bar

The **Menu Bar** is a specialized **Toolbar.** Press its buttons to call the list of commands available to perform actions inside the program (see **Figure 3.7**). The structure of the Menu is described in Chapter 7 – The Menu Structure.

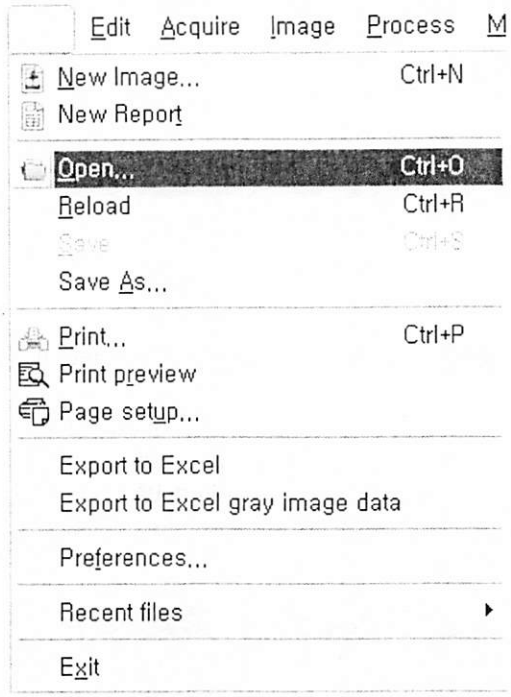


Figure 3.7. An Example of the drop-down menu.

Status Bar

The Status Bar is located at the bottom of the Main window (see Figure 3.8). It displays several panes:

- active-image calibration name
- active-image color model and color information about a pixel under the pointer, when the pointer is over an image
- pointer coordinates (in pixels), when the pointer is over an image
- active-image dimension
- active-image Pixel Depth

It also displays summaries of menu commands when the menu is active and the pointer is over a command. The right mouse click in the Status Bar area will display the context menu, which allows you to show/hide any pane (you can see an example of this menu in Figure 3.8).

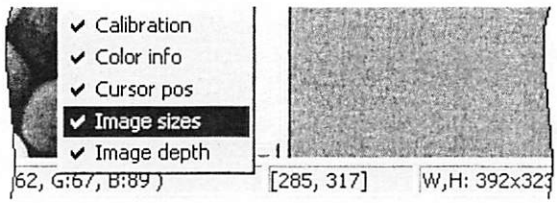


Figure 3.8. Status Bar's Context Menu.

The left part of the Status Bar can show a progress-bar indicator. This control is displayed only when a long operation is executed, for example during the loading of a large file. The progress bar represents the progress of operation and may display additional information about executed operation. Figure 3.9 shows an example of a progress bar.

Figure 3.9. An example of a **progress bar indicator.**

Use the **View➢Status Bar** command to show or hide the **Status Bar.**

Context window

The **Context window** (or Image Manager window) is a window that shows all the opened images. It contains a set of buttons. Each button has a thumbnail of one image. If the image document has several images, each of them will have its own button. Thus, the Context window includes thumbnails of all the images, and it allows you to work with them more comfortably.

An example of the Context window is shown in **Figure 3.10**

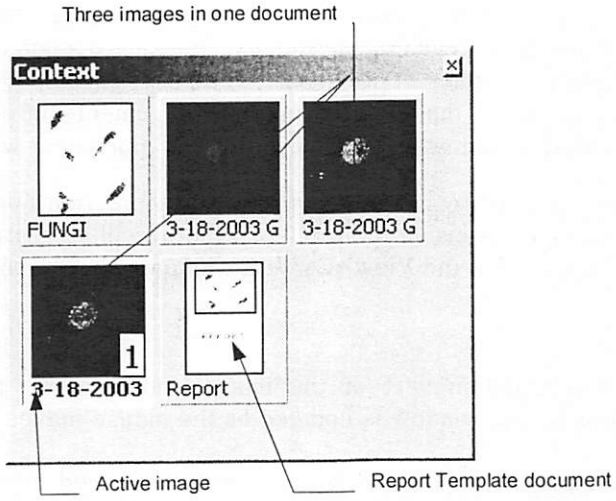


Figure 3.10. An example of the **Context window.**

The active document has a button with a yellow frame. If the image document has several images, the buttons of these images also have yellow frames (see **Figure 3.10**). An image button displays as "pressed" only when the active document window displays this image.

A button also has an image or document name. If the name is too long it is displayed only partially. Place the mouse cursor above the button to display a tool tip with the name of the image.

Some image operations require several images to perform their actions, such as the **Process➢Fast focus enhancement** operation. Thus you need to select several images. The Context window helps you to realize this operation. The image button can have a figure on it. Usually for an active image it is **1**. If several images are selected, each of their buttons has its own figure. These figures show the order of the selected images. To select some images and to specify the order of the selected images, you need to click the left mouse button on the desired image buttons, while holding down the [CTRL] key on the keyboard. You can use the same method to deselect the images, and the figures will disappear from the image buttons. With the [SHIFT] key you can choose several images at a time.

Figure 3.11 shows the Context window with three selected images.

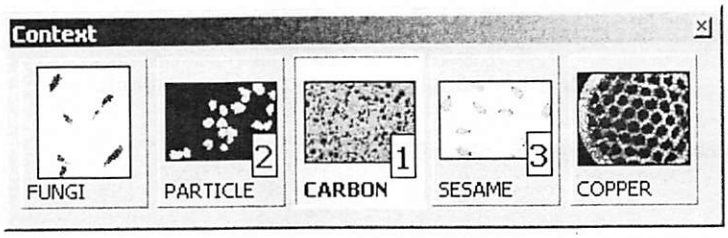


Figure 3.11. Selected images in the **Context window**.

The Context window lets you activate any image by a left mouse-button click on the desired image button. As a result, the whole image document becomes active, and its document window is shown over all document windows. Regardless of how many images are contained in the image document, the active image will be displayed in the document window.

All the opened Report Template documents also have buttons that are contained in the Context window. Unlike the image document, each of the Report Template document has only one button no matter how many pages it contains. The Report Template document thumbnail shows the active report page. If you click on the Report Template document button, this document will become active and its document window will be shown over all document windows.

The Context window can be resized by clicking and dragging the corners or sides of the window. During this operation all the buttons inside the Context window will be rearranged. You can show or hide the Context window by using the **View➢Context window** menu command.

ZoomIn window

ZoomIn window shows a zoomed-in part of the image under mouse pointer in the active document. Information in this window is updated as the mouse moves.

Figure 3.12 shows an example of the ZoomIn window. The contoured pixel in the center of the window indicates the mouse pointer position. Marking of this pixel is optional. It can be switched on/off in the "**General**" tab of the "**Preferences**" dialog in the "**File**" option.

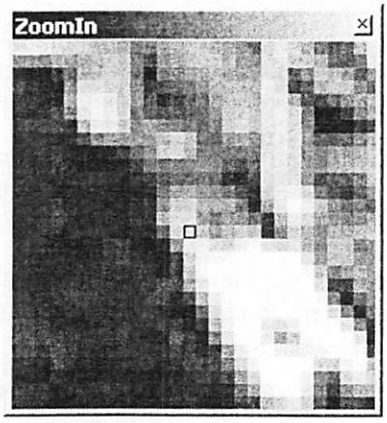


Figure 3.12. An example of **ZoomIn** window.

The ZoomIn window can be resized by clicking and dragging the corners or sides of the window. You can show or hide the ZoomIn window by using the **View➢ZoomIn window** menu command.

Document window

Document window is a window that displays document contents (images, Report Template, measured data, measured objects, annotations, and others). It also allows you to manipulate document data.

Figure 3.13 shows an example of the document window of the Image document.

A document window is created at the moment a document is created. The document stays open as long as its document window is open. Closing the document window closes the document. Only one document is active at a time. The document with an active document window is the active document. You will find more detailed information about documents and how to work with them below in this chapter.

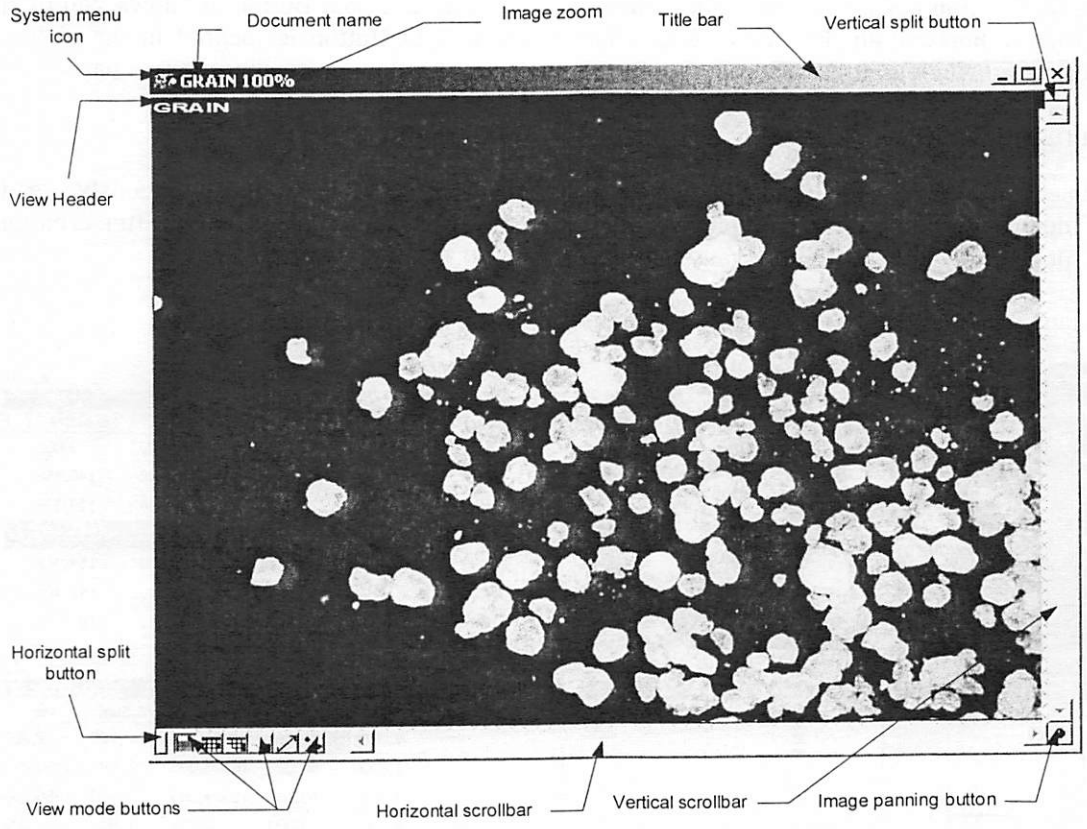


Figure 3.13. An example of document window.

The upper part of the document window contains a **title bar**. The left part of the **title bar** contains the **System Menu Button**, the document name, and some additional information depending upon the active view mode. The right part has the **Minimize**, **Maximize** and **Close** buttons (see **Figure 3.13**).

Click on the **Close** button to close the window and free the memory used to store the document. An alternate way to close the window is to click with the mouse on the **System Menu Button**. A menu will drop down and you can then choose the **Close** menu item. You can perform the same action by choosing the **Window➢Close** menu command or by pressing the [CTRL] + [F4] shortcut key on the keyboard.

Click on the **Maximize** button to enlarge a window to its maximum possible size. In this case a document window will occupy the entire program workspace, and other document windows will

be invisible.

Click on the Minimize button to reduce the window to an icon. Minimized windows are placed along the bottom of the program workspace. You can restore a window size and position by clicking the **Minimize** button or by double-clicking its icon.

Like any window, a document window can be moved by dragging its title bar. It also can be resized by clicking and dragging the **corners** or sides of the window.

Since several documents can be opened simultaneously, several document windows can be displayed in the program window. You can use the [CTRL] + [Tab] or [SHIFT] + [CTRL] + [Tab] shortcut keys to activate the next or previous document window correspondingly. Another way to do the same is to use the **Window➢Next** or **Window➢Previous** menu commands.

In the left bottom corner of the window there is the **Horizontal Split Button**. It allows you to split the window horizontally into two parts. The **Vertical Split Button** is located in the right top corner of the window. It allows you to split the document window vertically into two parts.

Document window splitting

Document window lets you display two or four parts of the document simultaneously, i.e. the document window can be split into two or four parts, named **Panes**. Right after creation a document window contains only one part (or pane).

An example of the document window split into four parts is shown in **Figure 3.14**.

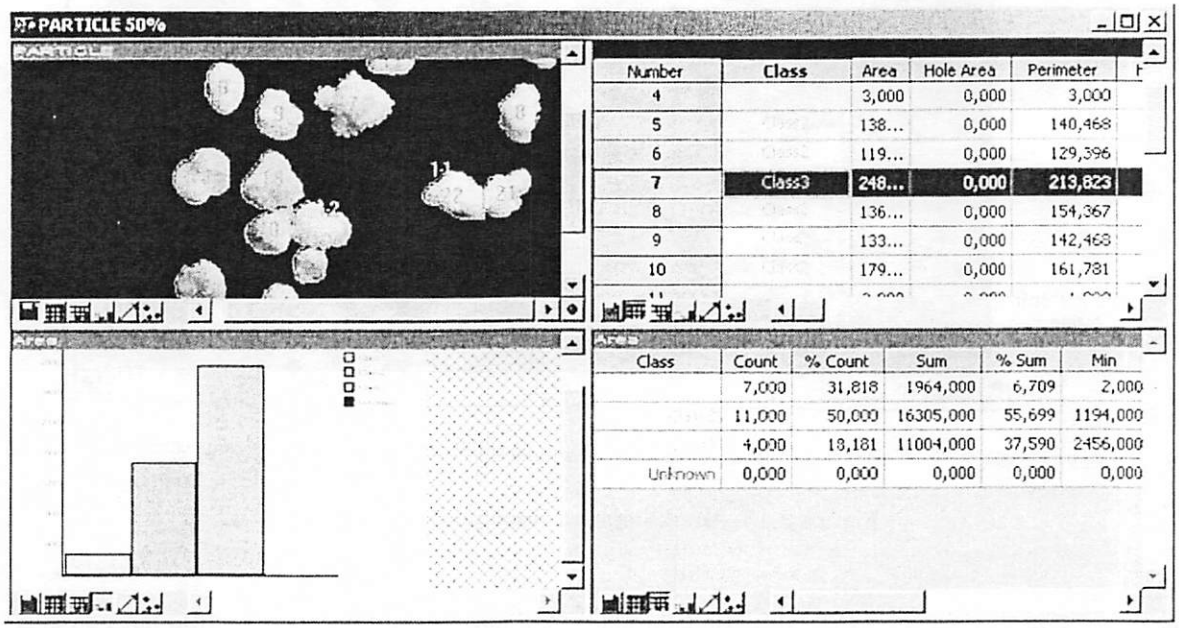


Figure 3.14. An example of the **document window** split into four parts.

- The **Horizontal Split Button** (see **Figure 3.13**) splits the document window horizontally into two parts. It is located in the left bottom corner on the horizontal scroll bar of the document window, or its part, when the window is split.

- The **Vertical Split Button** (see **Figure 3.13**) splits the document window vertically into two parts. It is located in the right top corner on the vertical scroll bar of the document window.

To move the separating line of the document window, place the mouse cursor on the line. The cursor will change its view depending on the type of the line. It can look like:

- a horizontal arrow when the document window is split vertically,
- a vertical arrow when the document window is split horizontally,
- a cross arrow when the document window is split into 4 parts.

Press the left mouse button and while holding it down move the line in the desired direction. Release the mouse button to fix the line.

An alternate way to split a document window is to double-click with the mouse on the **Horizontal Split Button** or **Vertical Split Button**. In any of these cases the document window will be divided into two equal parts.

You can also use the **Window ➤Split Horizontal** or **Window ➤Split Vertical** menu commands to perform this action.

To cancel the splitting of the document window, double-click with the left mouse button on the separating line you want to remove, or place the mouse pointer on the separating line and move it while holding down the left mouse button until it matches an image edge. If the window is split into four panes, move the cross point of the separating lines to an image corner.

An alternate way to cancel document-window splitting is to double-click with the left mouse button on the separating line you want to remove.

You can also use the **Window➤Split Horizontal** or **Window ➤ Split Vertical** menu commands to perform this action.

Each pane can display its own part of the document and contains **View Header, View, Vertical Scrollbar, Horizontal Scrollbar** and several buttons that allow you to change **view mode.**

Note: At any moment, for your convenience, only one **pane** can be active. An active pane has an active **View Header** (marked by blue color in the figure) and active (not gray) view mode buttons. This **pane** can get commands from the keyboard input.

Document Views

The main part of a document window or its part (split pane) is a **View.** There are several types of View, each of which can display the document contents in different formats. It is possible to switch the visible View type at any moment by clicking the **View ➤ View type .**

There are the following view types used for and Image document:

- Image View
- Manual View
- Manual Tags View
- Profile View

For a Report Template document there is only Report View.

Not all program commands are available for each type of View. All types of View will be described in detail below in this manual.

Documents

The program is designed mainly for working with images, but while working with the program new data may appear: measured objects, annotations, reports, enhanced images, measurement

and statistics data, etc. To save these data, use **Document**.

Document is a container with some data in it, for example one or more images, thresholded objects, results of measurements, and results of statistical treatment of the measurements data.

The program supports two types of documents:

- **Image Document** allows you to work with images and data related to them, such as thresholded objects, measurements results, and statistics.
- **Report Template Document** allows you to create reports, and helps you print the results of your work.

The program can work with image sequences, but an "Image Sequence Document" does not exist. Instead, the Image Document is used because it can contain several images loaded from one file. The Image Document has enough functionality to replace an Image Sequence Document.

Chapter 6 shows how to make report-template document to do tasks.

Each document has only one document window, functioning as follows:

- Document window is created during the last stage of the document creation.
- Document is closed as soon as the document window is closed.
- Document window allows you to manipulate the document contents.

It is impossible to work with document contents without a document window. The program is designed with the use of MDI-architecture, and a document window is created as a MDI-child window. It allows you to have several document windows in the program. But only one window can be active at any moment (the active window has a keyboard input), if at least one document is opened. This means several documents can be opened, but only one of them can be active.

A document that has an active document window is an **active document.**

You can see an example of document window in **Figure 3.13.**

Image document

The **Image Document** contains one or more loaded or captured images, results of their treatment, and data related to them: image attributes, thresholded objects, measurements results, etc.

Note: if the **Image document** has several images, only one image or its part can be displayed in the **document window.** To work with another image of this document you need to activate it in the **Context window.**

Report Template document

Report Template Document is a template that helps you print the results of your work: images, measurements, statistics, etc.

Working with documents

Making a new document

Keyword: CTRL+N

Menu: File➤New image...

The File➤New image... command shows the "New image" dialog. Use this dialog to select the type you want and then press the OK button or Enter key on the keyboard. If you want to stop this command, press Cancel or Esc on the keyboard. If the dialog ends successfully, a new document window will appear. A new image document contains a new image with basic size and color. A new report template contains one empty page.

Tip: [CTRL]+ [N] key on the keyboard allows you to perform the File ➤ New image... command.

Opening document

Menu: File➤Open...

The File➤Open... command shows the "Open" dialog. Using this dialog you can select the path and file you want to load. This command allows you to load several files simultaneously. If the dialog ends successfully and a new document (or documents) is created successfully too, the command will load the file (or files) contents to the document (or documents).

Opening recent documents

The File menu lists names of recently used files. By clicking on a menu item with the corresponding file name you can load recently used files. If this file is already opened, this command performs nothing. Otherwise it chooses a document type based on the file extension, creates a new document, and loads the file contents to this document.

Reload document

Use the File➤Reload command to reload the active document. This command shows a prompt to ensure you want to reload the active document. If you confirm, it closes the active document and opens it again. All previous changes of this document will be discarded.

Closing document

The Window➤Close command is used to close the active document by closing the document window. If a document has unsaved changes, a prompt will be shown to ensure you want to save the document before closing it, close it without saving, or cancel this command. Depending on your wish, the command will break or execute its action.

Saving document

The File➤Save command is used to save the active document changes to a file. If the active document is not saved yet, this command provides the same action as the File➤Save As... menu command.

Saving document with new name

The File➤Save As... command is used to save the active document changes to a file with a new name. It shows the Save As dialog, in which you can choose the path to save a file and type a new file name. If the Save As dialog is ended successfully, the command will try to save a document with the selected path and the new name. If this procedure is completed successfully too, the active document will have the new name.

Working with commands

The program provides a lot of commands and tools that allow you to manage the program execution. Each command performs some single action (loads a file, filters an image, etc.) or repeats its action many times (draws a line, outlines an object, etc.). You can start a command by clicking a button on the toolbar, by choosing a menu item, by pressing a key on the keyboard, or by other ways. Usually the menu provides a full set of commands. The toolbars and the keyboard shortcuts give access to a set of these commands; they provide an alternative way to start the commands.

Commands and menus

A **menu** is a list of menu items, and each menu item is a command. When you choose a menu item the corresponding command is started. Most commands are available to execute only if certain conditions are satisfied. The menu item state represents the command's availability. If the menu item is disabled (gray) it means the corresponding command cannot be executed. For example, if a document is not changed the **File➢Save** menu item is disabled, but the **File➢Exit** menu item is always enabled.

Most of the menu items are prefaced by icons. You can also judge a command state by the state of an icon.

You can find an example of the menu item states in **Figure 3.15**.

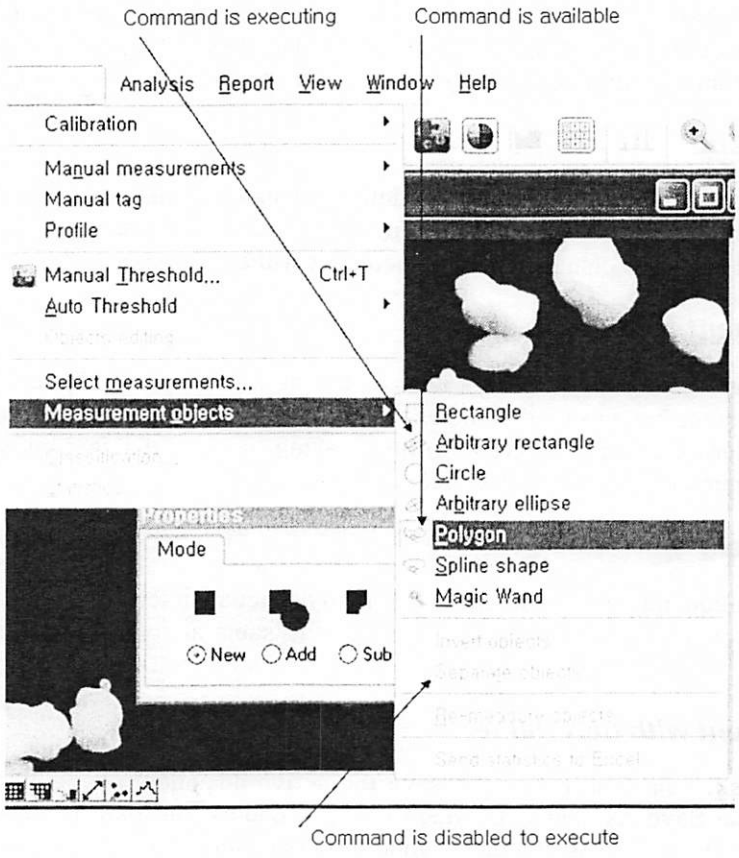


Figure 3.15. An example of menu item states.

Interactive Commands

Interactive commands are a set of commands designed to make one kind of work repeatedly, for example, the Edit➢Annotate➢Line command. During execution of this command you can draw a straight line on an image. To do it you need to click the left or right mouse button and move the mouse pointer, i.e. this command is required to interact with a user. After the desired straight line is drawn the command is restarted automatically because it can create only one straight line.

Command is **interactive** if it needs to interact with a user to perform its action. Usually interactive commands are repeated until a user cancels them. An interactive command is also called a **tool**.

Command settings

Some interactive commands allow you to change their settings. These commands have one or more tabs containing controls that let you change command settings. For example, the Edit➢Annotate➢Line command has two tabs. The "Color" tab allows you to choose the Background and Foreground colors of the drawn line. The "Figure" tab lets you change the styles of the line endings and the line thickness. These tabs are included in the "Properties" tab dialog, which is displayed until the command is executed. After the command is ended, these tabs will hide.

An example of the Edit➢Annotate➢Line command properties tab window is shown in Figure 3.16.

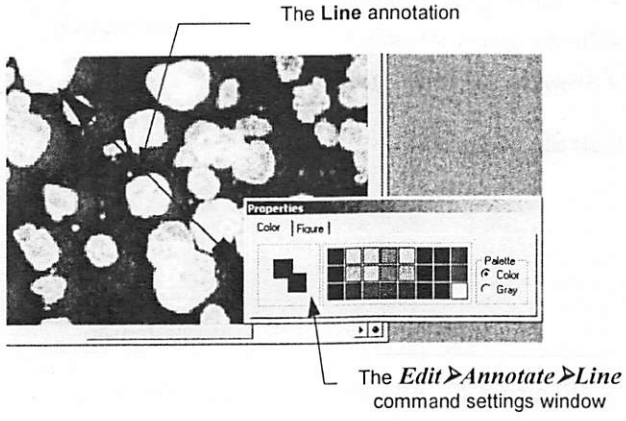


Figure 3.16. An example of the "Properties" tab window for the Edit➢Annotate➢Line command.

Note: Some interactive commands cannot get new settings until restarted. If you want to immediately apply new settings to such commands, you need to restart them manually.

Options and Settings

The program lets you customize general aspects of the program to your own specifications. You can read about how to customize the toolbars above. Here are some other options that can be changed:

- colors of object contours and measurement contours
- measurement label colors
- measurement label contents

- depth of undo stack (number of commands that can be undone)

These changes can be done in the "**Preferences**" tab dialog. There are six different tabs that can be opened and used to control the program. They are:

- General tab
- Measurement tab
- Report tab
- Excel tab
- Sequence tab

The complete description of each of these tabs is given below.

General tab

You can see an example of the "**General**" tab in **Figure 3.17.**

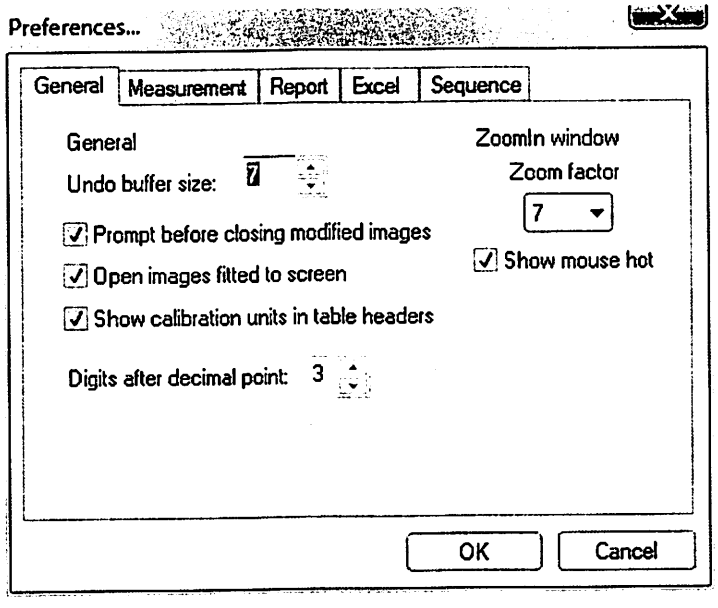


Figure 3.17. An example of "**General**" tab.

This figure shows the following:

- **Undo buffer size** field allows you to specify the depth of the Undo stack (number of commands that can be undone).

- **Prompt before closing modified images** flag lets you indicate that the program can issue a warning asking if you want to save a modified image before attempting to close it.

- **Open images fitted to screen** flag lets you indicate that the program must adjust the magnification and the window size of a just-opened image so that the **entire** image is displayed in the window.

- **Show calibration units in table headers** flag influences the display of **Object, Statistics** and **Measurement** views.

- **Zoom factor** control allows selecting more appropriate magnification strength for the **ZoomIn** window.

- **Show mouse hot** flag shows in the **ZoomIn** window the exact position of the mouse pointer on

the image.

- **Digits after decimal point** flag allows you to show digits after the decimal point. It can show up to three digits after the point.

Measurement tab

You can see an example of the "**Measurement**" tab in **Figure 3.18.**

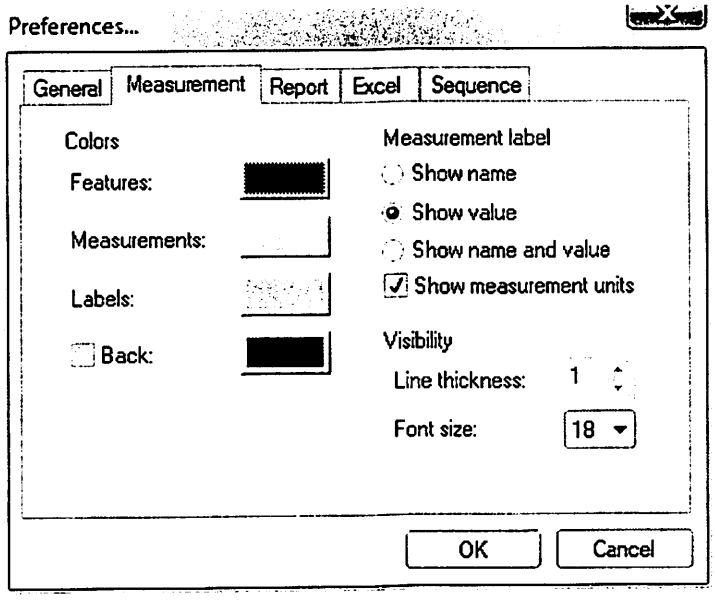


Figure 3.18. An example of "**Measurement**" tab.

This figure shows the following:

- **Colors** box contains three controls that allow you to specify the colors:
  - **Features** control lets you specify the color that will be used to draw measurement features.
  - **Measurements** control lets you specify the color that will be used to draw measurements.
  - **Labels** control lets you specify the color that will be used to draw measurement labels.
  - **Back** lets you see the background of the drawn measurement labels.
- **Measurement label** box contains controls that allows you to specify contents of measurement labels:
  - **Show measurement name** lets you specify that measurement labels will display the names of measurement features. If you select this field the **Show measurement units** field is disabled.
  - **Show measurement value** lets you specify that measurement labels will represent values of measurements. If you select this field the **Show measurement units** field is enabled.
  - **Show measurement units** lets you specify that measurement labels will display the units of measurements together with the measurement values.

- **Show measurement name and value** lets you specify that measurement labels will display the names of measurement features and the values of measurements at the same time. If you select this field the **Show measurement units** field is enabled.

- Visibility box:

  - **Line thickness** field specifies the object thickness of manual measurements.

  - **Font size** shows the size of figures that show measurement values.

Report tab

You can see an example of "Report" tab in **Figure 3.19.**

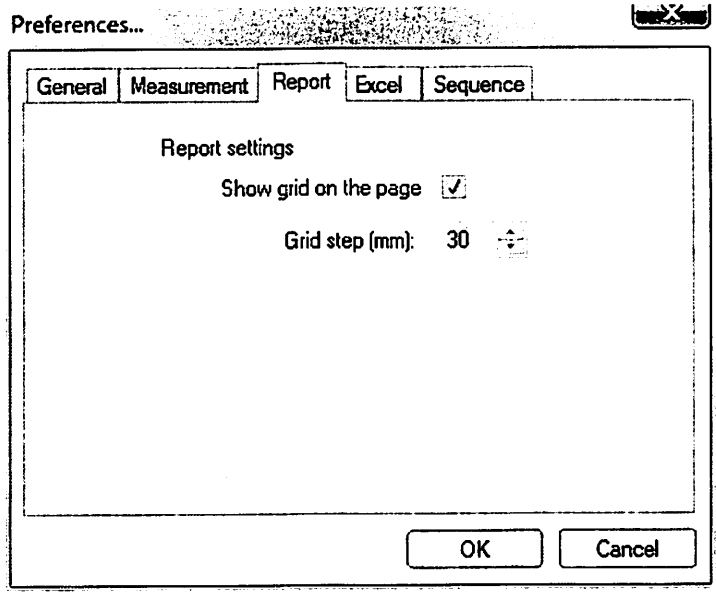


Figure 3.19. An example of "Report" tab.

This figure shows the following:

- **Show grid on the page** lets you specify that the program need to displays grid lines on a report page in the Report View. The grid lines can help you set placeholders and other object positions and sizes.

- **Grid step** field allows you to change a grid step.

Excel tab

You can see an example of the "Excel" tab in **Figure 3.20.**

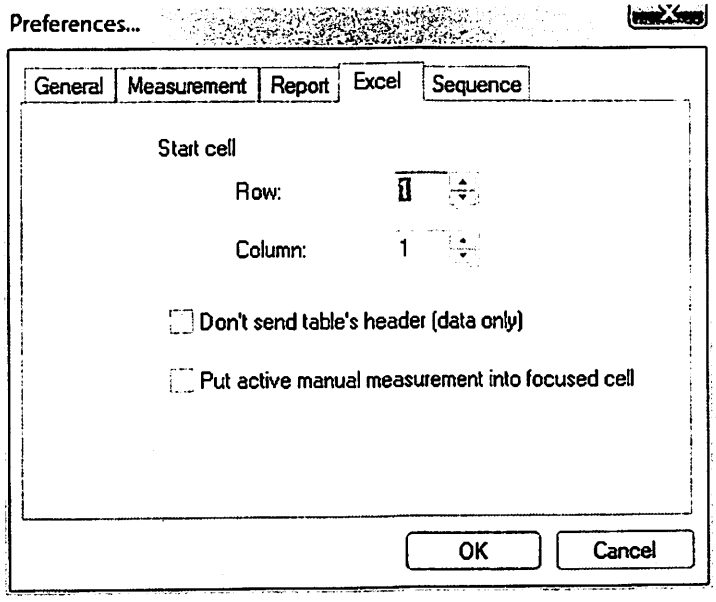


Figure 3.20. An example of "Excel" tab.

This figure shows the following:

- **Row and Column** of the starting cell in the Excel sheet where the program will transfer information.
- **Don't send table's header (data only)** will transfer only the data to the Excel sheet.
- **Put active manual measurement into focused cell** will transfer manual measurement value to the focused cell of Excel sheet.

Sequence tab

You can see an example of the "Sequence" tab in **Figure 3.21.**

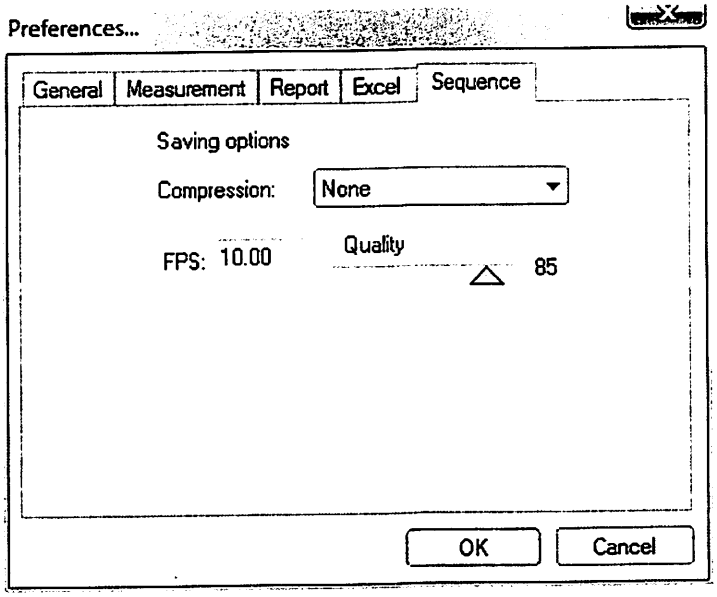


Figure 3.21. An example of "Sequence" tab.

This figure shows the following:

- **Compression** allows you select an appropriate method of compression for a saved video stream.
- **FPS** (Frames per second) determines the speed of further playback of a saved video stream.
- **Quality** control allows you to specify the desired power of the video compression while saving a sequence to a file. Less quality yields smaller file size and worse video output.

Chapter 4 - Working with Images

Image manipulation is one of the main tasks of Image analysis, and the program provides a lot of tools for modifying and transforming images. This chapter describes procedures ranging from simple tasks such as copying, resizing, or rotating an image, to advanced tasks such as image filtering.

Supported file formats

The program supports several different image file formats. The number of colors that a file can contain is determined by the pixel depth (bits-per-pixel): the more information is recorded for each pixel, the more shades and hues a file can contain.

The table given below lists the image formats that are supported by the program, the type of support that is provided (read, write, or both), and the format's bits-per-pixel levels.

Supported Image Formats: = program can open files, = program can save files

Format	Sub-Format or Compression	Source/Standard	BPP and Color Type						
			1	4	8 Grey	8 Color	16	24	48
BMP	RGB encoded	Microsoft Windows							
BMP	RLE encoded	Microsoft Windows							
GIF	Ver.87a (interlaced)	CompuServe							
GIF	Ver.87a (non-interlaced)	CompuServe							
GIF	Ver. 89a (interlaced)	CompuServe							
GIF	Ver.89a (non-interlaced)	CompuServe							
JPG	Huffman compressed	Joint Photo. Expert Group							
JPG	Progressive	Joint Photo. Expert Group							
PCX	Version 0	ZSoft Paintbrush							
PCX	Ver.2 (with palette info)	ZSoft Paintbrush							
PCX	Ver.3 (without palette info)	ZSoft Paintbrush							
PCX	Version 5	ZSoft Paintbrush							
TGA	Compressed	Truevision							

TGA	No compression	Truevision							
TIFF	Huffman compressed	Aldus Corporation							
TIFF	Pack bits compression	Aldus Corporation							
TIFF	LZW compressed	Aldus Corporation							
TIFF	No compressed	Aldus Corporation							

The table below lists the image-sequence formats that are supported by the program.

Type	File extension	Support	Comment
AVI	*.avi		Standard Windows video format
MOV	*.mov		Apple Quick Time
MPEG	*.mpeg, *.mpg		Compressed

The table below lists the native file formats that are supported by the program.

Type	File extension	Support	Comment
Image Document	*.img		This format is used to store the whole program Image document.
Report Template Document	*.rpt		This format is used to store the program Report Template document.

Opening Images

When you select the **File➢Open...** menu or press the [CTRL] + [O] shortcut key on the keyboard, the **"Open"** dialog box will appear. You can find an example of this dialog in **Figure 4.1.**

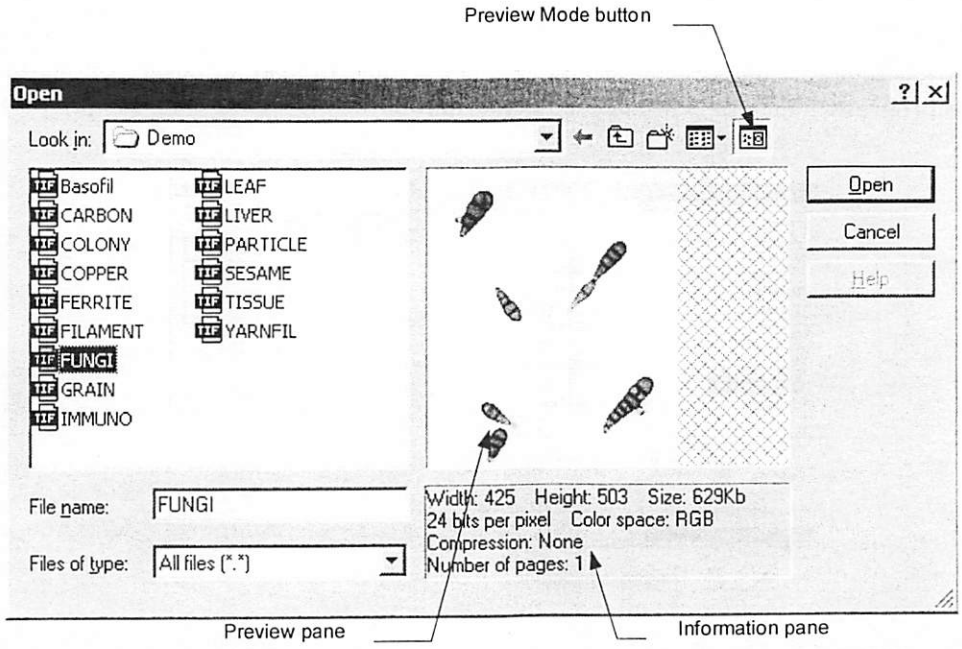


Figure 4.1. The "Open" dialog box.

Using this dialog you can select the path and file you want to load. It seems like a standard Windows "Open" dialog box, but it has an important addition. The program "Open" dialog box has **Preview** mode. You can toggle this mode by pressing the **Preview Mode** button that is placed on the right side of the dialog toolbar.

Preview mode

When Preview mode is turned on, both the **Preview pane** and **Information pane** are visible. These panes allow you to see images and get image information just before you load them. You can see these panes on the right side of the dialog in **Figure 4.1**.

The **Preview pane** displays the single image that is contained in the selected image file. After you select a new file in the dialog file list, the image will be displayed in the **Preview pane.** If the selected file contains several images, only the first one will be shown in the **Preview pane.**

The **Information pane** displays information about the selected image:

- image dimension (width, height),
- color space (grayscale or RGB) and pixel depth,
- number of images in a file,
- file compression type,
- file size.

If you select several files in the dialog file list, the **Preview pane** and **Information pane** will be empty.

Note: You can preview only the images that are contained in files with formats supported by the program. The **Files of type** dropdown box includes the list of all supported file

formats.

If you want to preview a big size file it may take some time to load an image. During the image loading the progress indicator will appear on the bottom of the dialog box, as you may see in Figure 4.2.

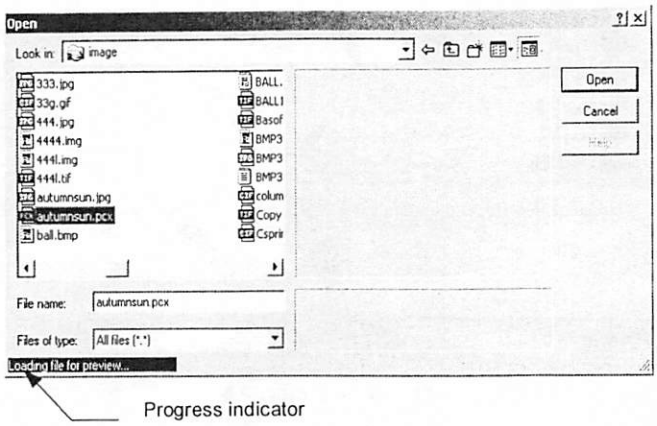


Figure 4.2. The "Open" dialog box during the file loading for preview.

The File➢Open... command allows you to load several files simultaneously. If the dialog ends successfully and a new document (or documents) is successfully created, the command will load the file (or files) contents to the document (or documents).

Note: If the loaded image has a Pixel Depth or Color Model not supported by the program it will be converted to the most suitable Pixel Depth or Color Model.

Creating a new Image

Use the File➢New Image... command to create an empty image of the specified dimensions and color model. After you choose this command the "New Image" dialog box will appear. An example of this dialog is shown in Figure 4.3.

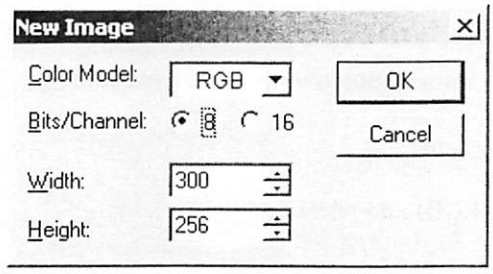


Figure 4.3. An example of the "New Image" dialog box.

This figure shows the following:

- The Color Model control allows you to select a color model for a new image.
- Bit/Channel allows you to specify the color depth for a new image. If you select the 16 radio button the pixel depth will be 16 BPP for grayscale images or 48 BPP for color images; otherwise the 8 radio button will remain selected, which means the pixel depth will take a value of 8 BPP for grayscale images or 24 BPP for color images.
- The Width edit box allows you to specify the new image width value in pixels. This value

establishes the number of pixels the new image will contain in the horizontal direction.

- The **Height** edit box allows you to specify the new image height value in pixels. This value establishes the number of pixels the new image will contain in the vertical direction.
- Press the **OK** button to create a new, empty image of the specified size and color model.
- Press the **Cancel** button to break the command execution.

When an empty image is created, all pixels are initialized with the highest intensity value for its type (e.g., 255, or white, for a grayscale 8 BPP image).

After an empty new image is created the new document window will appear.

Tip: You can use the [CTRL] + [N] shortcut key to perform the **File≫New Image...** command

After an empty image is created, the image data can be copied into it using the **Edit≫Paste** command.

Tip: You can use the **Edit≫ Paste New** command to create a new image from the contents of the Windows Clipboard.

Closing Images

To close an active image and remove its window from the screen choose the **Window≫Close** menu command, or click on the **Close** button in the upper right corner of the image window. If the active image document contains several images, all of them will be closed.

Note: If you have modified an image before attempting to close it, the program can issue a warning asking if you want to save it first. Choose the **File≫Preferences...** command, which will display the "**Preferences**" tab dialog. Set the appropriate flag in the "**General**" tab to issue a warning. Otherwise, set the preference not to warn you, and your image documents will close immediately with no changes and no warning.

Tip: You can do the same by pressing the [CTRL] + [F4] shortcut key.

New Report

Use this command to create a new report template document. The newly created report document will have only one page. If this command is performed successfully the new report window will be created, and it will display the active page of the report.

Reload

This command restores a modified image to the original image. If you saved the image with the same name as the modified image, the most currently saved image will appear.

Saving Images

Use the **File≫Save** command to immediately store the contents of the active document window to its file (the file name is listed on the window title bar). After this command is executed the image

and its window remain active.

Tip: You can perform the File➢Save command by pressing the [CTRL] + [S] shortcut key on the keyboard.

If the document window is untitled, it means the document is not saved yet, so the "Save As" dialog box will appear. An example of this dialog box is shown in Figure 4.4.

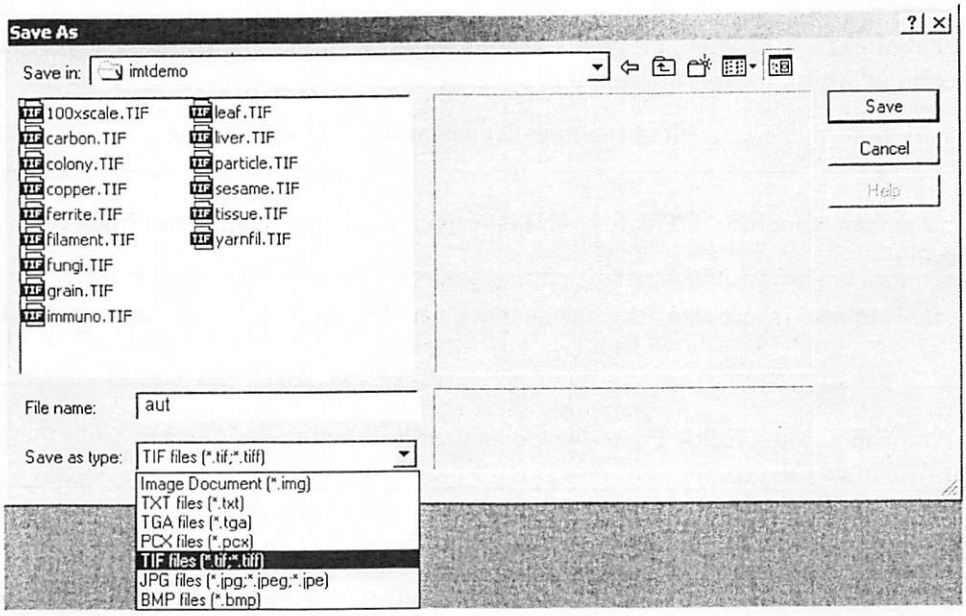


Figure 4.4. The "Save As" dialog box.

You need to type the document name in the File name edit box and press the Save button to continue the storing process.

You may also save your image in the specified format. To do this you need to choose the desired file format from the Save as type dropdown box. This box contains the list of all image file formats that are supported by the program.

The File➢Save command with *.img format saves the entire document and any document part, such as images, measured data, and statistics data, as well as its images, as a single file.

Print

Use this command to print one or more copies of the active report, or the active document view, to the selected output device. This command shows the standard "Print" dialog that lets you take full advantage of your printer capabilities.

Print Preview

Use this command to preview the active report or the active document view before printing. This command displays the "Print preview" dialog box that shows how the report pages will look before you print them.

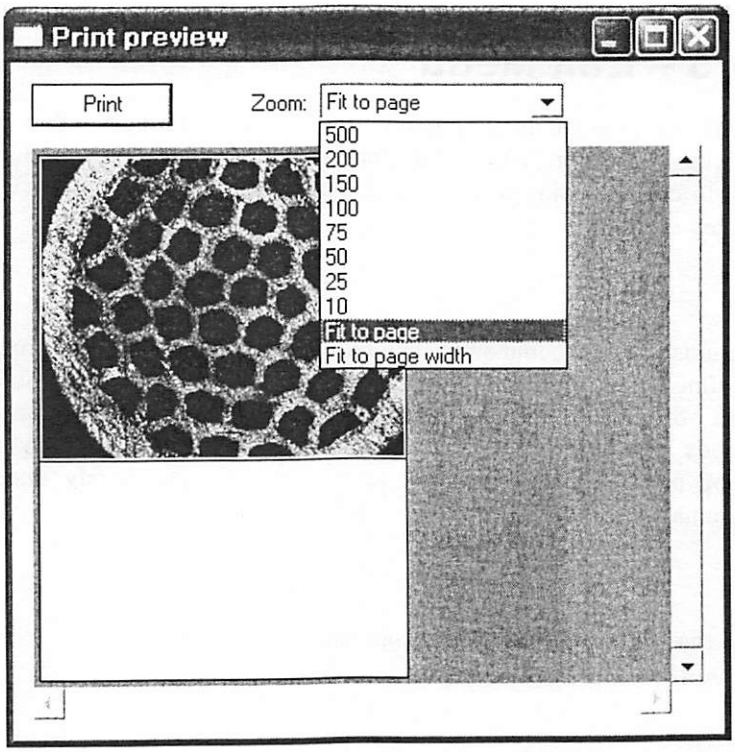


Figure 4.5. The "Print Preview" dialog box.

Page setup

Use this command to access the standard Windows "Page setup" dialog box for the printer you have selected. You can change the page layout settings using the controls in this dialog, and change the selected printer and its settings.

Export to Excel

Use the File ➢Export to Excel command to send to Excel information provided by a view. In the case of Image View, common information about the image will be transferred. Performing this command on 'preview' allows you to transfer image data to Excel without capturing the image.

Chapter 5 – Edit Menu

Edit menu contains commands you need to work with images. You can use the **Edit** menu commands to copy, crop, or paste all or part of images. The **Edit** menu also contains commands that allow you to change print properties of images and to modify view windows and information about the images.

Undo

To cancel the most recent commands, you can use the [CTRL] + [Z] command. The depth of the undo stack defines the number of commands that can be undone. You can change this in the "General" tab of the "Preferences" tab dialog, which can be displayed using the **File≫Preferences...** command. **Undo** command allows the image to undo the most recent commands. You can use this command to perform the previously undone commands (by the **Edit≫Undo** command) again.

Redo

Perform again the previously undone commands.

Copy

Use the **Copy** ([CTRL] + [C]) command to copy the contents of the region of interest (ROI) of the active image to the Window Clipboard. If the image has no ROI, the entire image will be copied to the Clipboard. The **Edit≫Copy** command will not change the contents of the active image (i.e., this command does not delete the copied pixels). Any data already existing on the Clipboard will be replaced.

You can paste the copied data to any opened image using the **Edit≫Paste** command. You can also create a new image directly from the Clipboard contents using the **Edit≫Paste New** command.

Paste

You can use the **Paste** ([CTRL] + [V]) command to retrieve data, images, or drawing objects from the Windows Clipboard. Before you perform this command, you need to check whether the image data exists on the Windows Clipboard (for more detail, see "**Copy**"). If you do not have the data on the Clipboard, the Paste command will not work. You can paste all image data on the Clipboard to any data format supported by the program. The program allows you to Paste *.bmp, and *.jpg format images that are copied to Clipboard from other programs. However, it sends you an 'error' message when the data is not image data but something else, such as text data, or spreadsheet data.

Paste New

By this command you can retrieve images or data from the Windows Clipboard and place them into a new image.

Before you perform this command, you need to check whether the image data exists on the Windows Clipboard (for more detail, see "**Copy**"). The **Edit≫Paste New** command is available only if the Windows Clipboard has valid image data in it. You can place the image data into the Clipboard using the **Edit≫Copy** command. After a new image is created, it becomes an active image. The pixel depth and color model of the new image will be the same as that of the original image. If a nonrectangular ROI or drawing object is copied into the Clipboard, the program uses its bounding box for the new image.

Delete

Use this command to remove the selected objects from your image or report page.

Delete All...

This command shows the "**Delete all objects**" dialog box, which contains the types of objects that may exist in your image. After you choose the types of objects you want to remove, and close this dialog by clicking the **OK** button, the objects with the selected types will be deleted from your image.

Annotating images

This set of commands and tools contained in the **Edit➢Annotate** popup menu allows you to add text labels, shapes, arrows, etc. on the image. The program lets you store your annotations (also known as overlays) in the program's native format file. Once the annotations are inserted into your image, you can change them. The annotations do not become a part of the image until you execute the **Image➢Apply vectors...** command.

Annotation commands are as follows:

- **Select**: You can use this command to select an annotation object. After that you can change its position or shape. You can also change the selected object properties using the "Properties" tab window, which will be displayed when you select a *single* object. The number and contents of the tabs depend on the object.

- **Line**: You can use this command to draw straight lines in the active image or in the active report page. Using the settings of this command, you may define the following line properties: color, width of your line, and types of end points of the line. Changing the types of the line end points allows the straight line to look like an arrow.

- **Spline**: This command allows you to draw closed or open-ended shapes outlined by a spline in the active image or in the active report page. Using the settings of this command, you may define the shape properties: background and foreground colors, width of contour, types of the end points, and filling mode.

- **Polyline**: This command allows you to draw a closed or open-ended polyline or a filled or thin polygon shape in the active image or in the active report page. Using the settings of this command, you may define the shape properties: background and foreground colors, width of outline, types of the end points, and filling mode.

- **Rectangle**: Use this command to draw filled or thin rectangular shapes in the active image or in the active report page. Using the settings of this command you may define the following shape properties: background and foreground colors, width of contour, and filling mode.

- **Ellipse**: You can use this command to draw filled or thin elliptical shapes in the active image or in the active report page. Using the settings of this command you may define the following shape properties: background and foreground colors, width of contour, and filling mode.

- **Apply Vectors**: This command makes already-drawn annotations, measurement objects, and manual-measurement objects become permanent parts of the image, so that they cannot be changed later. Go to **Image➢ Apply vectors**.

The above commands are available only in an Image View or in a Report View.

The **Edit➢Annotate➢Select** and **Image ➢ Apply vectors** commands require the presence of at

least one annotation object. The results of all these commands can be discarded by using the Edit➢Undo command.

Each drawing object has several properties. You can change object properties during the object creation process or later. The first six tools have a "Properties" dialog box, which is displayed while a tool is executing. This dialog has several tabs that allow you to change object properties.

Note: All object properties that you change while the tool is executing will be applied to the *next* created object. It means you need to change the object properties *before* it is drawn. It is also possible to change the object properties after selecting it by using the Select command.

The Edit➢Annotate and Image➢Apply vectors commands do not have tabs.

The Edit➢Annotate➢Select command can display the "Properties" tab dialog only if one drawing object is selected.

All the drawing objects have the "Color" tab. You can see an example of the "Color" tab window in Figure 5.1.

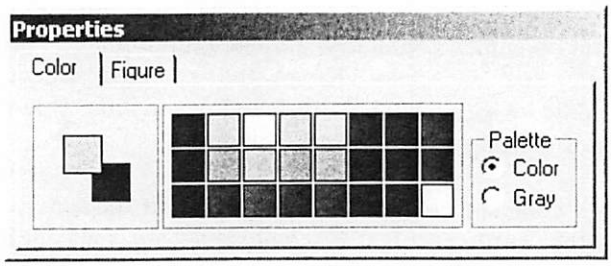


Figure 5.1. An example of the "Color" tab window.

This figure shows the following:

- This tab window allows you to choose Background and Foreground colors of the drawn object. In the left part of this window the currently selected colors are shown.

- The middle part is the Palette, which contains color buttons. You can change the object Background or Foreground color by clicking the right or left mouse button correspondingly on the Palette color button. Double clicking the left mouse button on the Palette color button calls the Windows "Choose Color" dialog, which can help you replace a color of this Palette button.

- The right part of the "Color" tab window contains switches. They allow you to choose the palette you want to use: color or grayscale. You can see an example of the "Color" tab window with a grayscale palette in Figure 5.2.

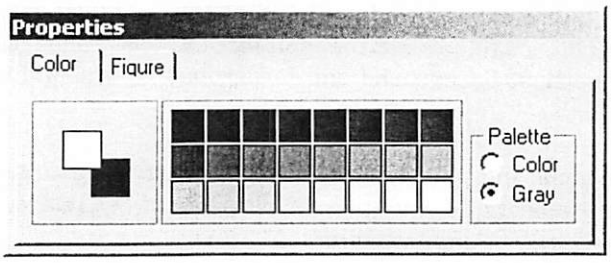


Figure 5.2. An example of the "Color" tab window with grayscale palette.

The other tab windows will be described below.

Line

The Edit➢Annotate➢Line command is used to draw straight lines and arrows on an active image.

To draw a line, you need to select this tool, then press the left or right mouse button on the location in your image where you want to start the line. Then hold the mouse button down, drag the mouse cursor to the desired ending point, and release the mouse button. As a result the line will appear.

The start and the end points of the line are marked by the endings. You can change styles of the line endings to make an arrow from a line.

While the line tool is executing, the "Figure" tab is displayed in the "Properties" tab dialog. It allows you to change styles of the line endings and the line thickness. You can find an example of the "Figure" tab window in Figure 5.3

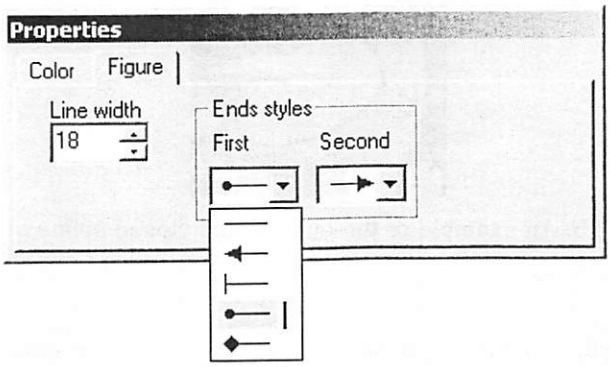


Figure 5.3. The "Figure" tab window for the Edit➢Annotate➢Line command.

This figure shows the following:

- The Line width control allows you to define the line thickness.
- The End styles controls allow you to change the styles of the line endings.

An example of an arrow is shown in Figure 5.4

Figure 5.4. An example of an arrow.

Spline

The Edit➢Annotate➢Spline command is used to draw an opened or closed spline line or spline shape on the active image.

Spline shape is a figure that is created as a bicubic spline from the given reference points. The spline shape is open if the start and end points of its contour are not equal; otherwise the spline shape is closed.

The spline reference points are set by the mouse button clicks. To create a spline, click the left mouse button at each point (including the beginning one). The spline edges will be drawn

automatically during spline creation. Double-click the left mouse button to close the figure.

The "**Figure**" tab window, which is displayed while the **Edit➢Annotate➢Spline** command is executing, lets you change the spline properties: the spline contour thickness, styles of the opened spline line ending, and filling mode for the closed spline shape.

The "**Figure**" tab window for the **Spline** command is the same as for the **Edit➢Annotate➢Polyline** command. You can find an example of the "**Figure**" tab window in **Figure 5.6** and in **Figure 5.7**.

The **Closed** flag on the "**Figure**" tab window turns your spline line into a closed spline shape. The area limited by the spline contour is filled according to the **Border/fill mode** property.

In the example in **Figure 5.5** you can see the opened and closed spline shapes.

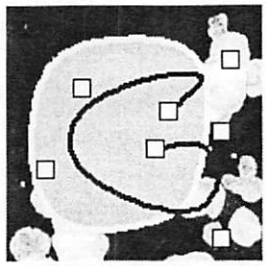


Figure 5.5. An example of the opened and closed spline shapes.

Polyline

The **Edit➢Annotate➢Polyline** command is used to draw an open or closed polyline or polygon shape on an active image.

The polyline is a figure that can include both straight line segments and smooth edges. The vertexes are set by the mouse button clicks. To create a polygon, click the left mouse button at each vertex (including the start point) in the polygon. Smooth edges are created by holding the mouse button down while you are dragging the mouse cursor. Double-click the left mouse button to end the polyline.

The "**Figure**" tab window allows you change the properties for the polygon or polyline, including polyline thickness and styles of the polyline ending.

You can find an example of the "**Figure**" tab window in **Figure 5.6.** and **Figure 5.7**.

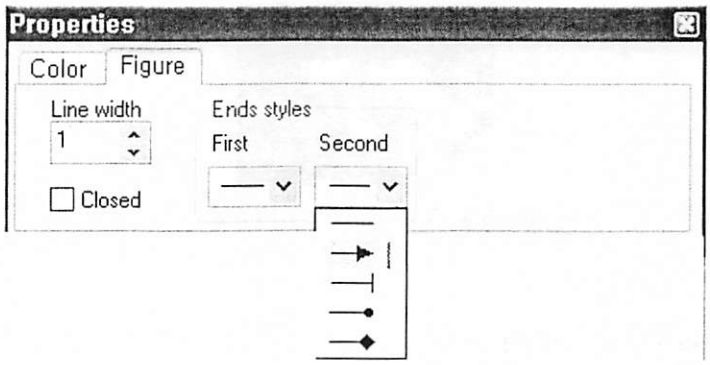


Figure 5.6. The "**Figure**" tab window for Polyline and Spline.

This figure shows the following:

- The **Line width** control allows you to define the polyline thickness.
- The **End styles** controls let you change the styles of the polyline endings.

- The **Closed** flag turns your polyline into a closed polygon.

Figure 5.6 shows the "**Figure**" tab window when the **Closed** flag is not checked.

If the **Closed** flag is checked, the **Polyline** command produces the polygon that is the area limited by the polyline just created. This area is filled according to the "**Figure**" tab window settings. You can see an example of the "**Figure**" tab window with the **Closed** flag checked in **Figure 5.7**.

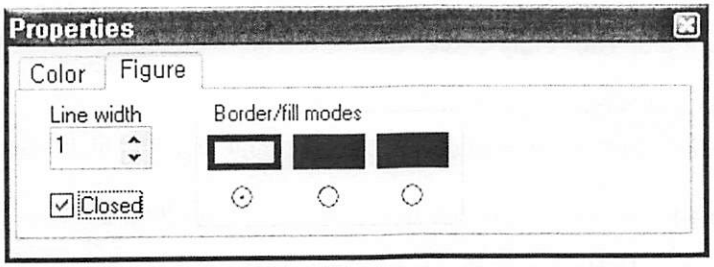


Figure 5.7. The "**Figure**" tab window for the Polygon and Spline shapes.

This figure shows the following:

- The **Line width** control allows you to define the polygon outline thickness.
- The **Closed** flag turns your polyline into a closed polygon.
- The **Border/fill mode** controls allow you to choose the polygon area filling mode.

You can see the polygon and polyline shapes in **Figure 5.8**

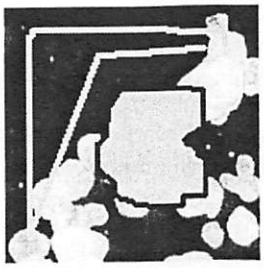


Figure 5.8. An example of the polygon and polyline shapes.

Rectangle

The **Edit➢Annotate➢Rectangle** command is used to draw a rectangle shape on the active image.

To draw a rectangle, place the mouse cursor in the desired position in the image and press the left mouse button. Then, holding the left mouse button down, drag the mouse cursor for the appropriate length and release the left mouse button. As a result the rectangle shape will appear.

The "**Figure**" tab window allows you to change the rectangle properties: the border thickness and the filling mode.

You can find an example of the "**Figure**" tab window in **Figure 5.9**.

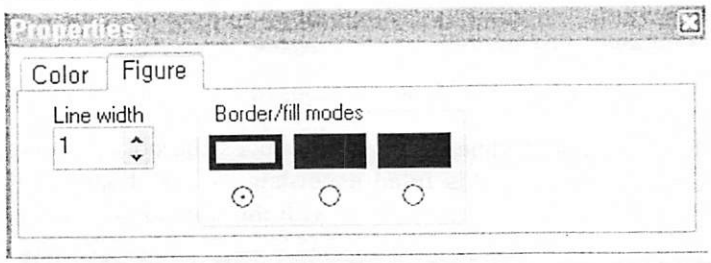


Figure 5.9. The "Figure" tab window for the Rectangle command.

This figure shows the following:

- The Line width control allows you to define the rectangle border thickness.
- The Border/fill mode controls allow you to choose the area filling mode.

An example of the rectangle shapes is shown in Figure 5.10.

Figure 5.10. An example of rectangle shapes.

Ellipse

The Edit➢Annotate➢Ellipse command is used to draw an elliptical shape on the active image.

To draw an ellipse, press the left mouse button in the desired location on the image. Then, holding the left mouse button down, drag the mouse cursor until an ellipse of the size and shape you need is produced, and release the left mouse button.

The "Figure" tab window for the Edit➢Annotate➢Ellipse command is the same as for the Edit➢Annotate➢Rectangle command. It allows you to change the ellipse shape properties: the border thickness and the filling mode. You can find an example of the "Figure" tab window in Figure 5.9

An example of the ellipse shapes is shown in Figure 5.11

Figure 5.11. An example of ellipse shapes.

Text label

The Edit➢Annotate➢Text label command is used to place text on the active image.
To draw the text you need to select the Edit➢Annotate➢Text label command first. Then click the left mouse button inside the image. While this command executes you will see an empty text box

and the "Properties" tab dialog with several tabs. After you release the left mouse button the "Text" tab will be active. After you enter the text on the "Text" tab and set its attributes and colors on the "Settings" and "Color" tabs, click the right mouse button anywhere on the image to finish this command.

The "Settings" tab window lets you select the text characteristics, such as type font, size, style and alignment, as well as special attributes such as bold, italic, or underlined.

Note: all these attributes are applied to the **entire** character string that will be applied to the image.

An example of the "Settings" tab is shown in Figure 5.12

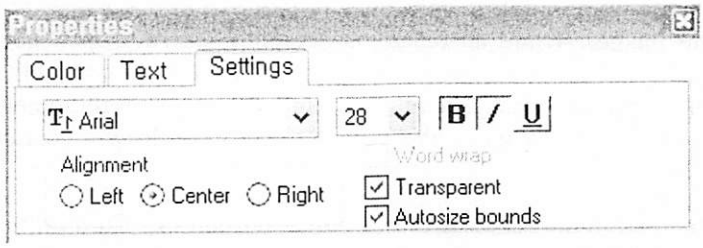


Figure 5.12. The "Settings" tab window.

Here the following properties are set:

- **Font** by which the text will be drawn and its attributes.
- Text **Alignment** in the rectangle surrounding it.
- If the **Word wrap** flag is checked, and the text cannot be placed in one line, it is automatically continued on the next line as soon as it reaches the edge of the bounding rectangle.
- **Transparent** lets the image show through a drawing on top of it. If this flag is not set, the text is enclosed in a box filled by the Background color.
- The **Autosize bounds** flag lets the rectangle enclosing the text change as the text changes.
- **Alignment** allows you to align the arrangement of the text.

An example of the "Text" tab is shown in Figure 5.13.

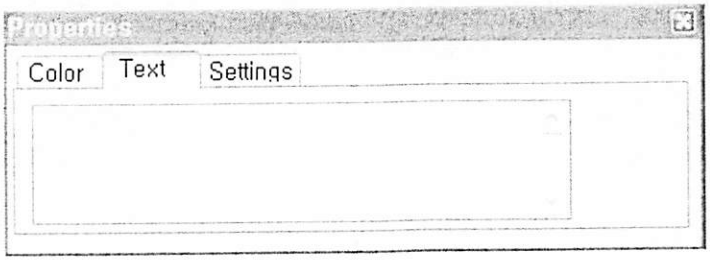


Figure 5.13. The "Text" tab window.

Here the text that will be displayed is set. An example of the text labels is shown in Figure 5.14.

Figure 5.14. An example of text labels.

Changing annotations

The Edit➢Annotate➢Select tool lets you select an annotation object from the earlier-drawn ones on the image. This command can select only objects that are not "burned" into the image (not a permanent part of the image). While an object is selected, its reference points are marked by white squares. Using this command, you may also select more than one object by holding down the [CTRL] key on the keyboard while clicking the mouse pointer on the objects. It is possible to select all the objects in an area by using the object selector to draw a rectangle to enclose the objects.

You may change all the annotation objects that are not "burned in." To do this, select the desired objects first, using the Edit➢Annotate➢Select tool. After the object reference points are drawn by white squares, you can change the object by dragging these points. You may also move the whole selected object or several selected objects by dragging any part of any selected object excluding reference points.

If you select only one object the "Properties" tab dialog with object-dependent tabs will be displayed, otherwise this dialog will be hidden. These tabs allow you to change object properties in the same manner as during object creation.

The menu commands Edit➢Copy and Edit➢Paste can be used to manipulate the selected objects. These commands allow you to copy the selected annotations to the Windows Clipboard and paste a new copy of them to the active image. You can perform the same actions by using the [CTRL] + [C] and [CTRL] + [V] shortcut keys.

The Edit➢Delete commands remove the selected objects. You can do this by pressing the [DELETE] button on the keyboard. You can also use the Edit➢Delete all... menu command to remove all the annotations from your image or report page.

Image info

Use the Edit➢Information... command to view the image information such as resolution, size, or color model. This command shows the "Information" tab dialog, which contains the following tabs:

- File tab,
- Image tab,
- Calibration tab.

File tab

The fields on this page display the file information associated with the image document that contains your image:

- File Name displays the name of the image file.

- **Size** displays the file size in bytes.
- **Format** indicates the format of the stored image: BMP, JPEG, sequence, etc.
- **Compression** indicates the compression method used to store the image, i.e. JPEG, LZW, etc.
- **Date** displays the date and time the image was created.
- **Access Right** indicates whether the file is stored with Read Only or Read/Write properties.
- **Entries Count** indicates whether there are more than one image stored in the file.

If the document is not saved to a file, all the fields will be empty.

Image tab

The fields on this page display information about image characteristics:

- **Width** indicates the image width in pixels.
- **Height** indicates the image height in pixels.
- **Color Space** displays a color model of an active image.
- **Channels** displays the number of color channels in an image
- **Bits per Pixel** displays the active image pixel depth (the number of bits per pixel). The bits per pixel is equal to the bits per channel multiplied by the number of channels.
- **Memory Size** displays the amount of memory the current image requires.
- **Pseudo-colored** indicates whether an image is pseudo-colored or not.

Calibration tab

The fields on this page display information about the spatial calibration used on this image.

- **Name** displays the name of the spatial calibration of an active image.
- **Unit Name** displays the name of units of the image spatial calibration.
- **Units per Pixel by X** shows the number of units that represent a single pixel in the horizontal direction.
- **Units per Pixel by Y** shows the number of units that represent a single pixel in the vertical direction.
- **Pixels per Unit by X** shows the number of pixels that represent a single unit in the horizontal direction.
- **Pixels per Unit by Y** shows the number of pixels that represent a single unit in the vertical direction.

For more information about the contents of these fields, please refer to the **Measure➤ Calibration...** command.

Chapter 6- Acquiring Images

The **Acquire** menu commands allow to you capture images directly from digital cameras or other image input devices (e.g., VCR). These commands let you see the image while making camera adjustments as well as while making subject adjustments. Using the **Acquire** commands you can manually or automatically capture images from the continuous video stream.

These commands also help you to select the appropriate hardware and software drivers, and configure your setup correctly.

Getting images from TWAIN device

The program has several commands that provide ways to obtain images from different image acquisition hardware, for example flatbed scanners, CCD cameras, digital cameras and other image acquisition equipment that support the TWAIN standard.

The scanning process involves the following three basic steps:

1. **Select your device** using the **Acquire➢Select TWAIN device...** command. If you know that the desired device has already been selected, this step is not required.
2. **Initiate the scan** using the **Acquire➢Acquire from TWAIN device...**command. While this command executes, the program transfers control to the manufacturer's TWAIN interface for the device you are using.
3. **Control the scan process.** See the manufacturer's user manual for operating instructions. When the scan is complete, your image will be displayed in a new document window.

Selecting TWAIN device

Use the **Acquire➢Select TWAIN device...** command to select or change the current TWAIN-compliant device. As a result, the "**Select Source**" dialog box appears (see **Figure 6.1**).

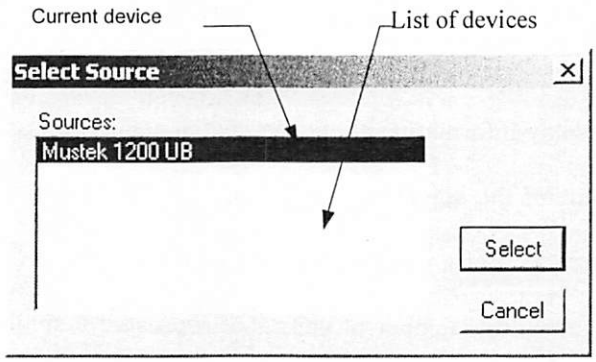


Figure 6.1. The Select TWAIN-compatible device.

This figure shows the following:

- The **Sources** list box presents all TWAIN drivers found on your system. Select the device you want to use. If your device is not listed under Sources, install it first, and then select it.
- The **Select** button is used to set a highlighted device as a current one.
- The **Cancel** button is used to keep the previously selected device as a current one.

Scanning Images

Use the **Acquire➢ Acquire by TWAIN device...** command to scan images into the program using a

TWAIN-compliant device. This command initiates the scanning process directly. If you have a TWAIN-compatible device installed, the appropriate control dialog appears. The scanning process is controlled by the manufacturer's TWAIN interface for the device you are using.
Usually the manufacturer's TWAIN drivers contain a user interface that provides a set of options. Select the desired options for your subject. You may be prompted to specify settings such as dpi (dots per inch) and whether you want to scan your subject as a black and white, grayscale, or color image. For the information on a specific scanning device, see the documentation provided with this device.

When the task is completed, the subject appears as an image. To save the image to a file, choose the **File➤Save** command.

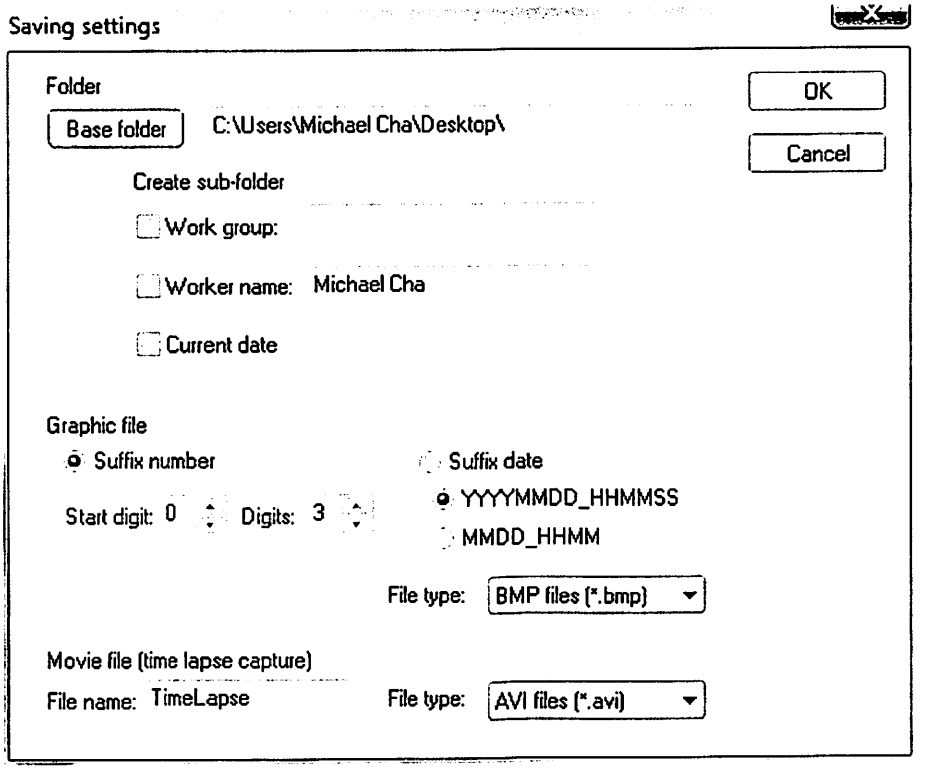
Note: Before selecting the **Acquire➤Acquire by TWAIN device...** command, be sure the current device matches the device connected to your system.

Getting images from a Video or Digital Camera

The program supports WDM (Microsoft® Windows® Driver Model) image-capture devices. For successful work with these devices it is necessary to have the special WDM driver for your device correctly installed in the system. In addition, the program supports some devices natively, via direct drivers.

In the **Figure 6.2** you can see an example of the **"Image capture"** dialog of the **Acquire➤Image capture...** command.

Note: If there is not at least one image device in the system that is supported by the program, the **Acquire➤Image capture...** command will be disabled.



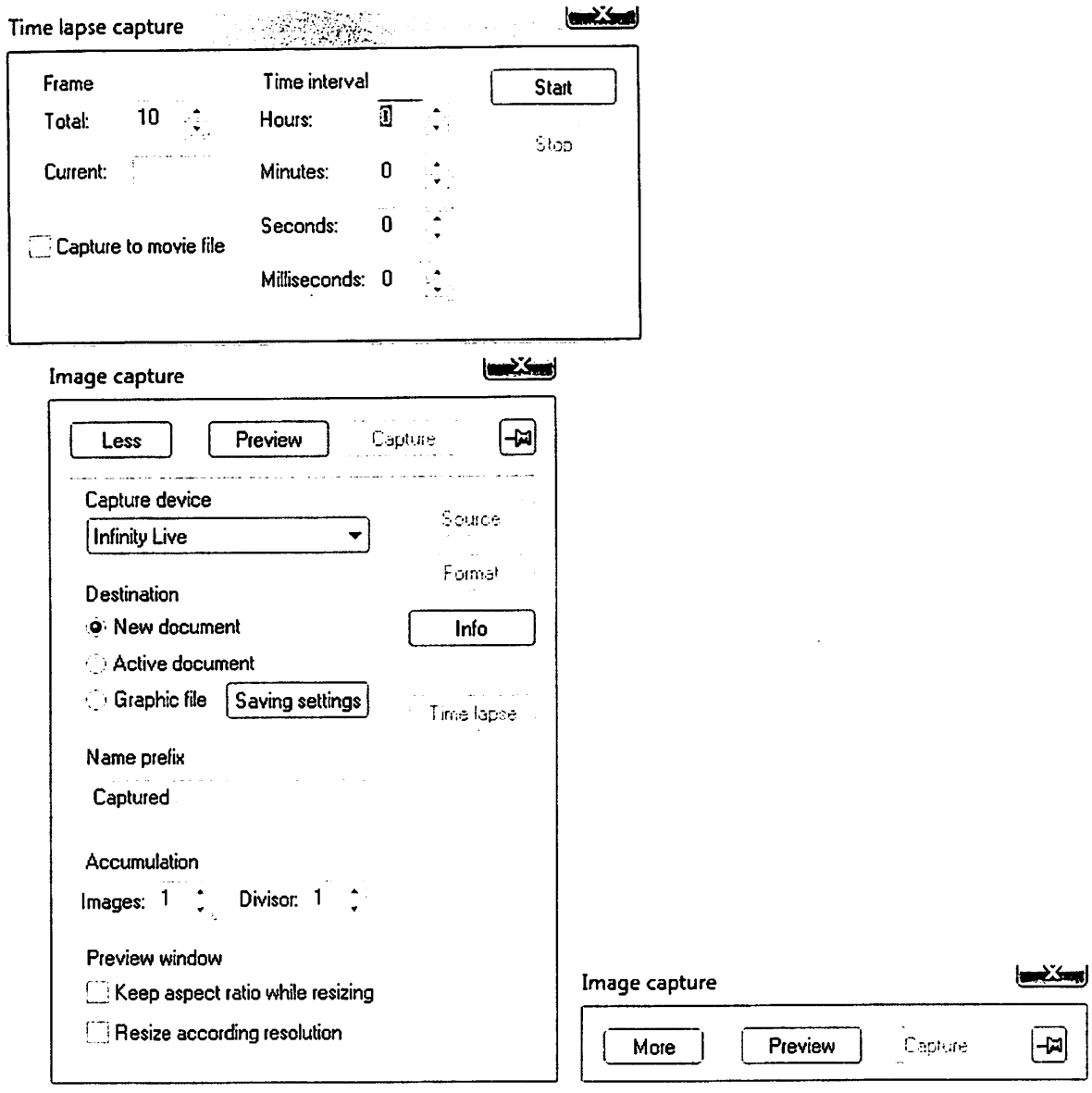


Figure 6.2. An example of **"Image capture"** dialog box.

This figure shows the following:

- **Capture device** control allows you to specify the device for image-capture operation from a list of devices correctly installed in the system and supported by the program.

- **Destination** group allows you to select the destination for the captured image. For each new captured image, a new document will be created or a captured image will be placed in the current active document. Thus a sequence of images will be produced.

- **Graphic file** option allows you to save the captured images on the selected location automatically.

- **Saving settings** provides a group of folders in which the image can be saved. You can also select and create folders as you wish. You can save captured images in the base folder option, or you can automatically create sub-folders in the **Create Sub-folder** option. The order for creating a sub-folder is: Work group, Worker Name, and Current date.

- **Name prefix** edit box allows choosing the basic part of the captured image name. For

example, when you type "time capture" in the box, the name of the image files will have names such as "time capture000", "time capture001," and "time capture003".

- **Accumulation** group allows you to set up parameters to make averaged capturing. Several consequently acquired images (exact number is determined by first edit box) are added to each other and finally the resulting image is divided by the value of the specified divisor (second edit box). If both edit boxes contain the same values (greater than one), a smoothing effect on the captured image will be obtained.

- **Preview window** group determines resizing rules for the preview window. If the **Keep aspect ration while resizing** flag is set, the preview window will always have a size that is proportional to the current device's image resolution. The **Resize according resolution** flag is used to resize the preview window each time the captured resolution is changed, so the preview window will reflect the current actual image size.

- **Source** button opens a device-specific dialog that allows some tuning of the device itself. For example, you can choose image input type, video standard, established appropriate brightness, and contrast of signal. If the selected device does not support such tuning, this button will be disabled.

- **Format** button opens a device-specific dialog that allows setup of the video stream format. This dialog most often contains controls for choosing frame rate, quality, output image size, and so on.

- **Info** button opens a device-specific dialog that contains information about the developer and version of the program driver for this device.

- **Preview** button allows you to open and close the preview window for a live image preview.

- **Capture** button allows you to capture still images into the program, according to selected parameters and tuning.

- **Less** option makes image capture window size minimized.

- **Time lapse** button is used to show the **Time lapse capture** dialog for automatic, periodic image captures. **File Prefix name** assigns the prefix for naming the image files to be captured. **Capture to movie file** saves the file in movie-file formats such as *.avi, *.mpeg, and *.mov. **Frame** selects the number of images to be captured. **Time interval** sets the time intervals (e.g. hours, minutes, seconds, milliseconds).

Note: A large value in the **Accumulation images** control will increase the time needed to capture video.

Live measurements

Live measurement is a special mode of Image View. It can be switched on/off by the **Acquire≫Live measurements** command. In this case the live image preview is in the Image View and it is possible to make most of the operations on the video like on a static image. The most useful application is for taking manual measurements on live preview. For obtaining video, the currently selected device is used. So to select an image device for live measurements and to tune the device settings, the **Acquire≫Image capture...** command must be used.

Command **Acquire≫Overlay settings** sets allows to setup several kind of information that will be drawn above video image both previewed and captured. Live measurement mode supports

overlays also. The command will show dialog box like in the **Figure 6.3.**

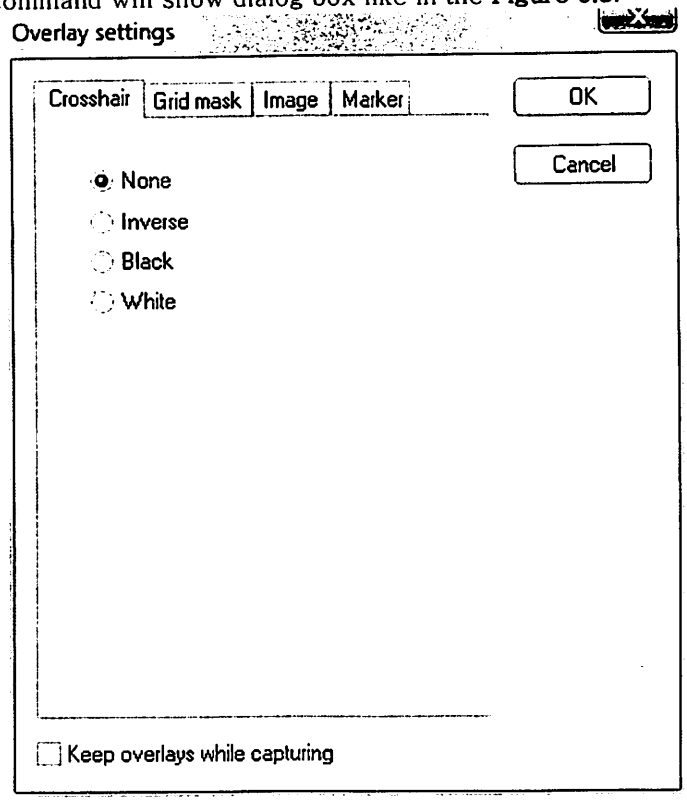


Figure 6.3.1. An example of **"Overlay settings"** dialog box

Here:

- **Crosshair** group box is used to switch on/off drawing two special lines (vertical and horizontal) that crossed in the center of image. **"None"** tap turns off crosshair. **"Black"** draws black lines and **" White"** gives white ones. **"Inverse"** allows you to see drawn lines with guarantee at any images, whereas white crosshair will be almost invisible on very bright images and black will be imperceptible on too dark images.

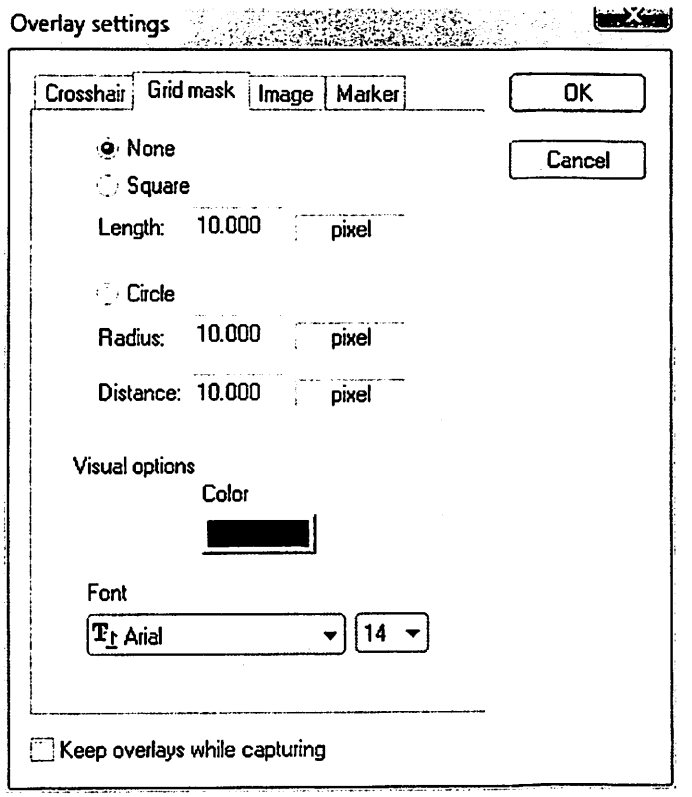


Figure 6.3.2. An example of **"Overlay settings"** dialog box

- **Grid mask** group box shows grids of squares and circles. Here, you can specify their length, radius, and distances. These figures will show additional information depending current active calibration. **"Visual options"** makes you to set the **"Grid mask"** color, font, and size of letters.

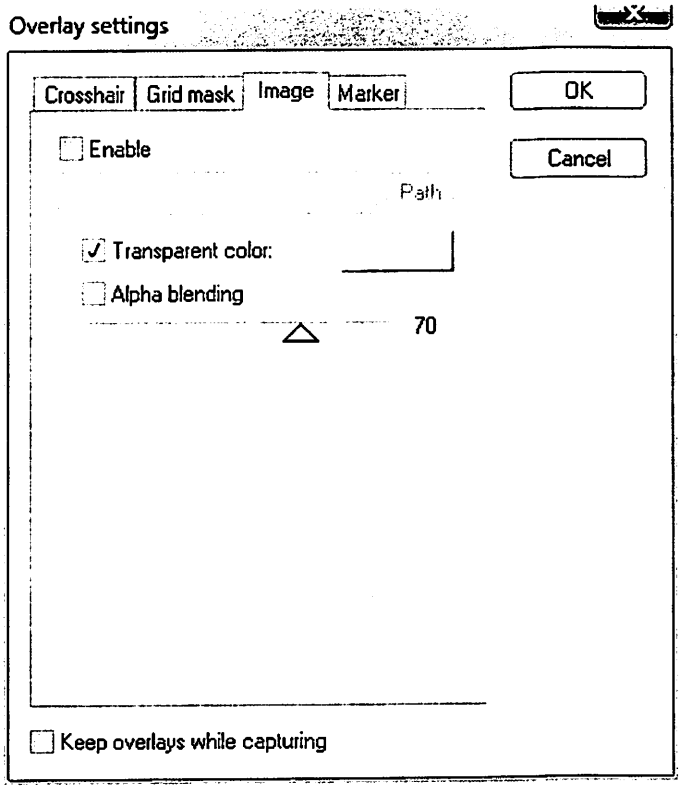


Figure 6.3.3. An example of "Overlay settings" dialog box

- **Image** group box allows to choose image file that will be shown above video image. "**Enable**" checkbox is needed to switch on this feature. With help "**Path**" button and/or corresponding edit box, on can specify the desired image file. All graphic files that supported by the program are allowable here. "**Transparent color**" option allows you to select the color that will be fully transparent on the overlay image, so this color will no disappeared from the overlay image and video image will be always shown instead. "**Alpha blending**" option allows to specify common transparency of the overlay image. 100% alpha blending means that overlay image is fully opaque, and 0% means full transparency.
- **Keep overlays while capturing** check box may be used to store overlays information on captured images too. If this check box is switched off, then selected overlays will be shown only while video preview and live measurement.

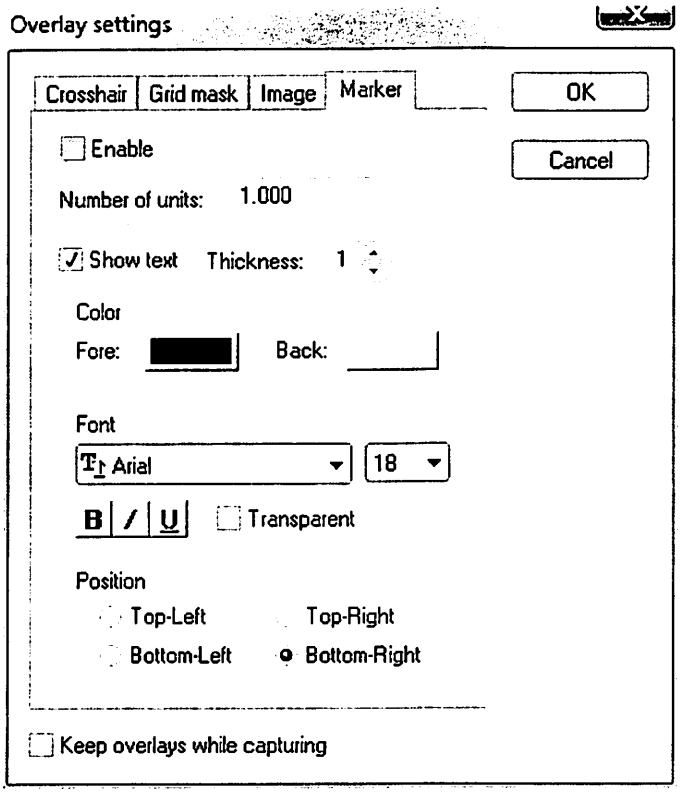


Figure 6.3.4. An example of "Overlay settings" dialog box

Marker group box allows you to place a calibration marker on the image as overlay. The "**Number of units**" tab allows you to specify the marker length in calibration units. "**Enable**" checkbox is needed to switch on this feature. "**Color**" allows you to specify the Background and Foreground colors. **Font** sets font and font thickness. **Position** sets the place of **Marker**.

Getting images from a PTP device

PTP (Picture Transfer Protocol) is an industry device communications standard that is supported by a number of digital-photo cameras. The program has the ability to obtain images from PTP devices under the Windows XP operating system. The PTP device has to be properly installed in the system, connected to the computer, and switched on. In this case, after executing the command to **Acquire➤ Get image from PTP camera**, a standard dialog like the one shown in

Figure 6.5 will appear.

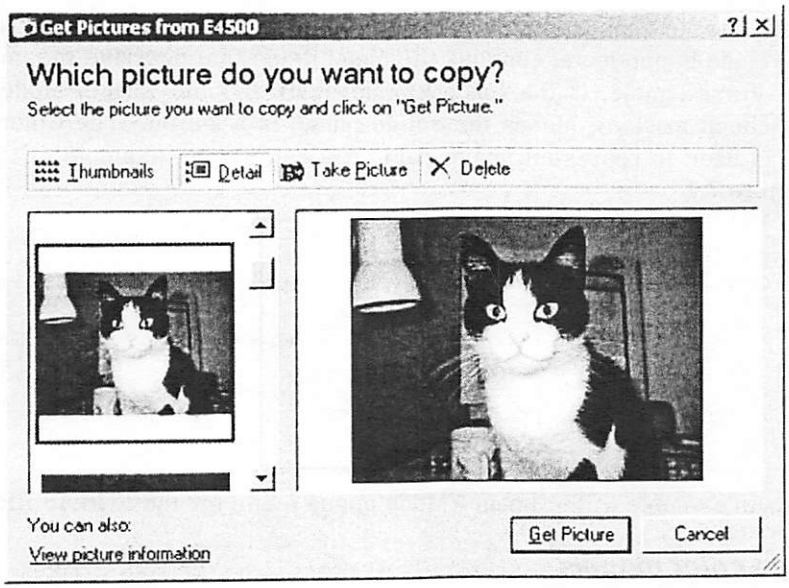


Figure 6.4. Getting images from PTP device.

Using this dialog box, it is possible to take a shot, delete some existing pictures, and transfer selected images into the program.

Please refer to the documentation of your digital camera to learn how to activate PTP communication mode, if it is supported by your hardware.

Chapter 7 - Images

Here you will learn how to change the color model and pixel depth of images. When an image is active the **Image➤Mode** popup menu contains the menu items that describe the image pixel depth and color model. For example, if the **Image➤Mode➤RGB** and the **Image➤Mode➤8 Bit/Channel** menu items have check marks it means the active image is a 24-bit True Color image and the RGB color model is used to represent image data. You can see an example of the **Image➤Mode** popup menu in **Figure 7.1.**

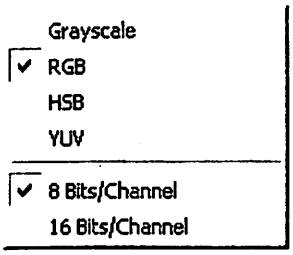


Figure 7.1. An example of the **Image➤Mode** popup menu for the RGB 48 BPP image.

Changing image color models

You can change the color model for the active image. You can do this to perform editing or analysis upon the image using another model. You might also do this to save the image data in a model other than RGB for use with an external program.

The program supports the **grayscale, RGB, HSB,** and **YUV** color models and allows you to convert images from one color model to another. During the converting operation the LAB color model is used as an intermediate format. It uses 16 bit values for each color component to provide lossless converting.

To change the image color model you need to choose the desired color model from the available ones in the **Image➤Mode** popup menu. After you select the desired color model the image will be converted. This operation can take some time, so while it is performing the **Status Bar** will display the progress indicator. You may break the operation at any moment by pressing the [ESC] button on the keyboard.

Note: If you convert a color image to a grayscale image you will loose the color information, which will be impossible to restore later.

Changing image pixel depth

You can change the pixel depth of images. The **Image➤Mode** popup menu allows you to choose how many bits per color channel your image may have. The program supports images with 8 or 16 bits per color channel. That means the following image types are supported:

- **Grayscale 8 BPP** has an 8 bits per color channel,
- **Grayscale 16 BPP** has a 16 bits per color channel,
- **Color 24 BPP** has an 8 bits per color channel,
- **Color 48 BPP** has 16 bits per color channel.

To change the image pixel depth, choose the **8 Bit/Channel** or **16 Bit/Channel** menu items from the **Image➤Mode** popup menu. After you select the desired color model, the image will be converted. This operation may take some time, so while it is performing the **Status Bar** will display the progress indicator. You may break the operation at any moment by pressing the [ESC] button on the keyboard.

The program uses the bit-shifting scaling technique to convert the pixel value between 8 and 16 bits per color channel. For example, if an active image is a grayscale one with 8 BPP the **Image➤Mode➤8 Bit/Channel** menu item has check marks. After you have chosen the **Image➤Mode➤16 Bit/Channel** menu item the image will be converted to a grayscale image with 16 BPP.

Show image in the view

The image menu always sets the default as the base option. You can change this option by clicking the left mouse button to deselect the option. You will see only vector images—outline images—not the background image.

Duplicating images

Sometimes you need to have another copy of an image in a separate window. For example, if you want to experiment with an image, but do not want to risk modifying the original, this feature is useful.

To duplicate an image make it active, then choose the **Image➤Clone** command. A copy of the selected image will appear in a new document window.

Cropping images

Sometimes you need to process and analyze only part of an image. In this case you may want to replace the image by its part. Use the ROI tools to select an area on an image. Then choose the **Image➤Crop ROI** command, or the appropriate toolbar button, to create a new image that contains only pixels within the ROI bounding rectangle.

The new image will be created in a new Image document, and will appear in a new document window. The cropped image will have the same pixel depth and color model as the image from which it was created.

Copying and Pasting images

You can use the Windows Clipboard to work with images.

Copy

Use the **Edit➤Copy** command to copy the contents of the ROI of the active image to the Window Clipboard. If the image has no ROI, the entire image will be copied to the Clipboard. The **Edit➤Copy** command will not change the contents of the active image (i.e., this command does not delete the copied pixels). Any data already existing on the Clipboard will be replaced.

You can paste the copied data to any opened image using the **Edit➤Paste** command. You can also create a new image directly from the Clipboard contents using the **Edit➤Paste New** command.

The **Edit➤Copy** command puts the image data to the Clipboard in Device Independent Bitmap (DIB) form, so many programs can get the image from the Clipboard.

Tip: You can perform the same action by pressing the [CTRL] + [C] shortcut key on the

keyboard.

Paste

Use the **Edit➤Paste New** command to place the contents of the Windows Clipboard into a new image. A new Image document will be created to store this image. After the new image is created, it becomes the active image.

The **Edit➤Paste New** command is available only when the Windows Clipboard has valid image data in it. You can place the image data into the Clipboard using the **Edit➤Copy** command.

The program will accept image data from other applications via the Clipboard when the data is in the form of a Windows bitmap or a Device Independent Bitmap. If the Clipboard contains non-image data such as text this command will be unavailable to execute.

With the **Copy➤Paste** command, the program will automatically locate the Clipboard data on the left top of the window. After you paste the data on the selected image, a cursor with four-direction arrows will appear and you can draw them anywhere you want.

Tip: You can perform the same action by pressing the [CTRL] + [V] shortcut key on the keyboard.

Paste new

Use the **Edit➤Paste New** command to place the contents of the Windows Clipboard into a new image. A new Image document will be created to store this image. After the new image is created, it becomes the active image. The depth and color model of the image is the same as its original image.

The **Edit➤Paste New** command is available only when the Windows Clipboard has valid image data in it.

The program will accept image data from other applications via the Clipboard when the data is in the form of a Windows bitmap or a Device Independent Bitmap. . If the Clipboard contains non-image data such as text this command will be unavailable to execute. If a nonrectangular ROI is copied into the Clipboard, the program uses its bounding box for the new image.

Using ROI tools

The set of **Region-of-Interest (ROI)** commands is used to choose the desired area on an image.

The **Region-of-Interest (or ROI)** is an area in an image that is defined by outlines. It allows you to work with the desired part of the image in the same manner as with the whole image, but the rest part of the image will stay untouched.

A lot of commands takes into account an image ROI and operate only upon the pixels within the ROI. For example, the image filter works only for the points inside of an image ROI, if present.

An ROI created on an image appears as a dashed outline. More than one ROI can exist at a given time and they are always visible. An active ROI has an animated contour.

A **Region-of-Interest** can be defined by any closed shape. To draw an ROI the following commands contained in the **Image➤ROI** popup menu are used:

- **Rectangle** defines a rectangle area on an image.
- **Arbitrary Rectangle** defines a rectangle area on an image turned to an arbitrary angle relative to the image X- and Y- axes.

- **Circle** defines a circle area on an image.
- **Arbitrary Ellipse** defines an ellipse area turned to an arbitrary angle relative to the image X- and Y- axes.
- **Polygon** defines a free-form area on an image outlined by a polygonal shape.
- **Spline shape** defines an area on an image outlined by a bicubic spline shape.
- **Magic Wand** defines an area on an image by using the "magic wand" function.

All these commands are available only in the Image View of the document window. They allow you to draw the ROI outline using the mouse. The details of drawing techniques used for each ROI type can be found below in the ROI commands description. When any of these commands execute the produced ROI contour is drawn.

The results of all these commands can be discarded by using the **Edit➢Undo** menu command.

The program also allows you to have a complex ROI that is set of some ROIs. You can manipulate the complex ROI as with the single ROI. The detailed description of how to create the complex ROI can be found below.

Rectangle ROI

The **Image➢ROI➢Rectangle** command defines a rectangular area on an image. The coordinates of the top-left and bottom-right corner points are set by one mouse click. To make a Rectangle ROI you need to press the left mouse button (it is the start point), then holding the left mouse button down, drag the mouse pointer to the desired position (it is the end point), then release the left mouse button. The line, drawn from the start point to the end point, is the rectangular diagonal. While this tool is being used the produced rectangle ROI contour is drawn.

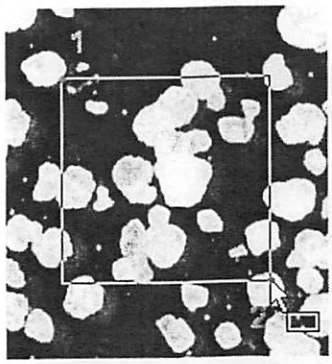


Figure 7.2. Rectangle ROI creation.

In the example shown in **Figure 7.2.** the **start** point is marked by digit 1, and the **end** point is marked by digit 2.

Arbitrary Rectangle ROI

The **Image➢ROI➢Arbitrary Rectangle** command defines a rectangular area that is turned to an arbitrary angle relative to the image X- and Y- axes. It allows you to define the medial segment of a rectangle (that gives the rectangle width) and a half of the rectangle height using the mouse.

To make an **Arbitrary Rectangle ROI** you need to press the left mouse button. It gives the start point of the rectangle medial segment. Then, holding the left mouse button down, move the mouse pointer to the desired position and release the left mouse button; that gives the end point of the rectangle medial segment. Now you have a medial segment of the rectangle, specifying

the rectangle length. After that, drag the mouse pointer to the desired position and click the same mouse button; that gives you a side point of the rectangle. The distance between the side point and the medial segment is half of the rectangle height.

During this tool execution the produced rectangle ROI contour is drawn.

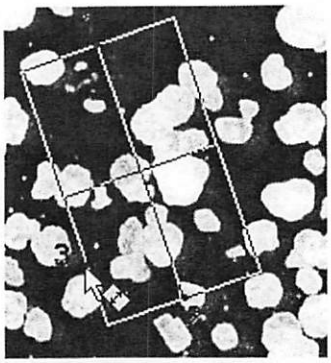


Figure 7.3. Arbitrary Rectangle ROI creation.

In the example shown in **Figure 7.3** the **start** and **end** points of the rectangle medial segment are marked by digits 1 and 2, and the **side** point of the rectangle is marked by digit 3.

Circle ROI

Image➢ROI➢Circle command defines a circle area on an image. You can create a Circle ROI by one click of the left mouse button just as described above, in Rectangle ROI creation.
To do it, press the left mouse button in the desired point of an image. It gives the start point for the circle diameter. Then hold the left mouse button and move the mouse pointer to the desired position and release the button. This is the end point of the circle diameter.

During this tool execution the produced circle ROI contour is drawn.

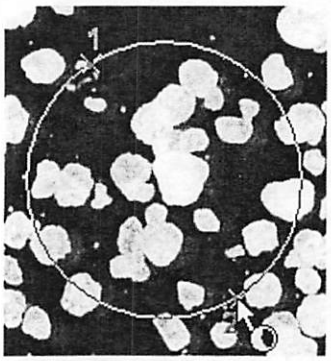


Figure 7.4. Circle ROI creation.

In the example shown in **Figure 7.4** the **start** point is marked by digit 1, and the **end** point is marked by digit 2.

Arbitrary Ellipse ROI

Image➢ROI➢Arbitrary Ellipse command defines an elliptic area on an image with the ellipse axes turned to an arbitrary angle relative to image X- and Y- axes. You can set the ellipse axes the same way as for Arbitrary Rectangle ROI.

To create an Arbitrary Ellipse ROI, press the left mouse button. It will give you the start point of the first main diagonal of the ellipse. Then hold the left mouse button down and drag the mouse cursor to the desired position, then release the left mouse button. That gives you the end point

of the first main diagonal of the ellipse. Now you have one main diagonal of the ellipse. After that, move the mouse cursor to the desired position and click the left mouse button; that gives you the side point of the circumscribed rectangle. The distance between the side point of this rectangle and the first main diagonal of the ellipse is a half of the second main diagonal of the ellipse.

During this tool execution the produced elliptic ROI contour is drawn.

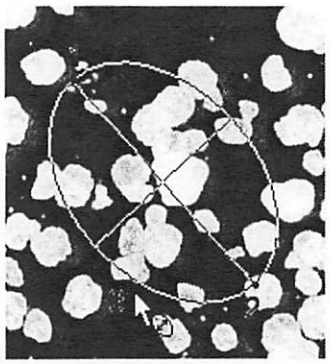


Figure 7.5 Arbitrary Ellipse ROI creation.

In the example shown in **Figure 7.5** the **start** and **end** points of the first main diagonal of the ellipse are marked by digits 1 and 2, and the **side point of circumscribed rectangle** is marked by digit 3.

Polygon ROI

Image➢ROI➢Polygon command defines a free-form area on an image outlined by a polygonal shape. A polygon is a figure limited by a polyline and including straight line segments and (or) smooth edges. The vertexes of the polyline are set by the left mouse button clicks.

To create polygons, simply click the left mouse button at each vertex in the polygon, including the beginning point. Smooth edges are created by holding the left mouse button down while you draw with the mouse cursor. To close the figure, simply double-click the left mouse button in any point of the image.

During this tool execution the produced polyline ROI contour is drawn.

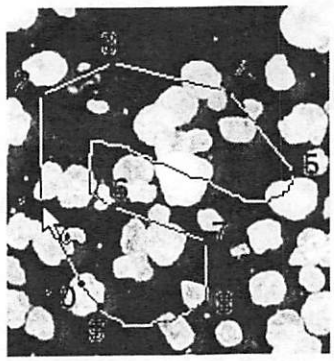


Figure 7.6. Polygon ROI creation.

In the example shown in **Figure 7.6** edges 5-6 and 8-9 are smooth edges. To draw the edge 5-6, press the left mouse button in point 5, hold it down and draw edge 5-6, then release the mouse button. Edge 8-9 is created the same way. The segment line 1-10 will be drawn automatically after you double-click the left mouse button to close the figure. All the other segment lines are drawn automatically while you create the figure. Points 1, 2, 3, 4, 7, and 10 are marked by the left mouse button clicks.

Spline shape ROI

Image➢ROI➢Spline command defines an area on an image outlined by a bicubic spline shape. To create a spline, set the spline reference points by the left mouse button clicks. Double click of this button will close the figure. During this tool execution the produced spline ROI contour is drawn.

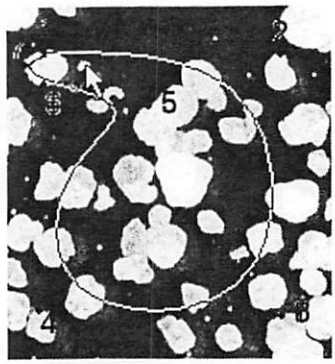


Figure 7.7. Spline shape ROI creation.

In the example shown in Figure 7.7 all the points are marked by the left mouse button clicks.

Magic Wand ROI

Image➢ROI➢Magic Wand command defines an area on an image by using the magic wand function. To make an ROI, place the wand cursor inside the area that you want to trace, and click the left mouse button. The Image➢ROI➢Magic Wand command will automatically trace the outline of the object (s) based on the color similarities or difference of intensity ranges between the pixels under your cursor, plus or minus a specified tolerance interval.

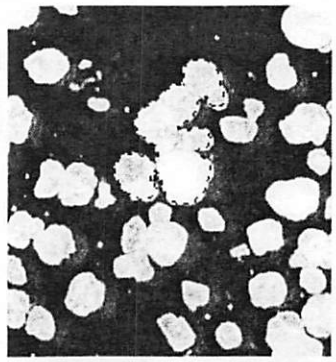


Figure 7.8. Magic Wand ROI creation.

In the example shown in Figure 7.8 Magic Wand ROI is drawn by dashed outline.

ROI command settings

Each of the ROI tools described above has a Mode property that shows how to interpret a newly created ROI. The "Mode" tab is displayed in the "Properties" tab dialog while any ROI tool is executing.

An example of the "Mode" tab window is shown in Figure 7.9.

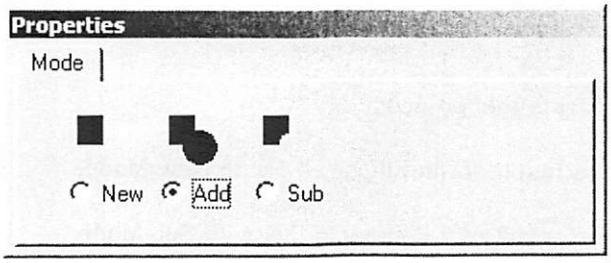


Figure 7.9. The ROI tool "Mode" tab window.

You can choose one of the three possible **Mode** positions:

- **New**: a new ROI will be created and a previously existing ROI will be removed.
- **Add**: if an ROI already exists a new Area will be added to it, otherwise a new ROI will be created.
- **Sub**: if an ROI already exists a new Area will be subtracted from it.

The **Image➢ROI➢Magic Wand** command also has the "**Magic**" tab, which allows you to change the magic wand options. You can find an example of the "**Magic**" tab in **Figure 7.10**.

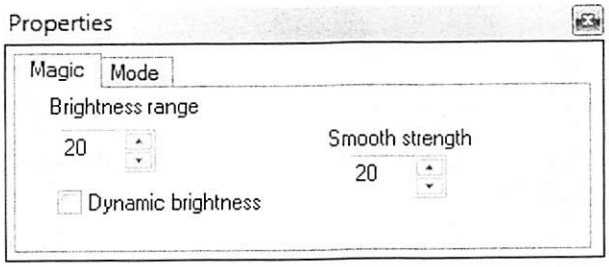


Figure 7.10. The **Image➢ROI➢Magic Wand** tool "**Magic**" tab.

This figure shows the following:

- **Brightness range** lets you specify the maximal deviation of intensity (relative to the given point). It is used at an area contour creation.
- **Dynamic brightness** is a flag indicating whether to take into account brightness range in each point of the created area contour. It is relative to the last created point or the given point.
- **Smooth strength** allows you to specify a degree of smoothing.

Complex ROI

A complex ROI can be presented by a set of several areas, created by different ROI tools. Since only one ROI can exist on an image you need to create a complex ROI by combining several areas.

Creating a complex ROI involves the following five basic steps:

1. Start the desired ROI tool by pressing the corresponding button on the "**ROI**" toolbar, or by choosing the needed menu item, then set **New** in its **Mode**.
2. Draw an ROI.
3. Start another ROI creation tool and set **Add** or **Sub** in its **Mode**.
4. Draw an ROI.

5. Repeat step 3 and 4 until the desired ROI shape is created.

The following figures illustrate this process:

- Figure 7.11a shows the result of an Ellipse ROI with **New Mode**,
- Figure 7.11b shows the result of a Rectangle ROI with **Sub Mode**,
- Figure 7.11.c shows the result of an Arbitrary Ellipse ROI with **Add Mode**,
- Figure 7.11d shows the result of the **Negative** filter applying to the complex ROI.

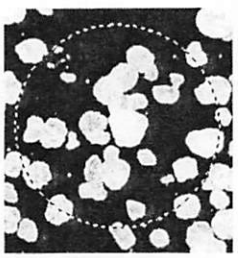


Figure 7.11.a.

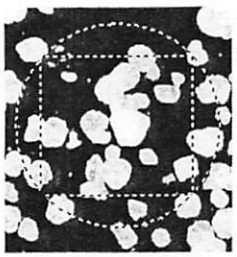


Figure 7.11.b.

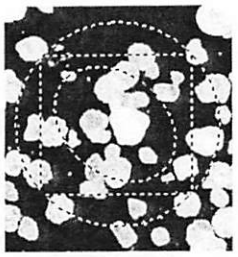


Figure 7.11.c..

Figure 7.11.d.

ROI manipulating

The program allows you to move, delete, and modify an ROI, and copy an ROI to the clipboard.

The ROI modifying is possible only by combining it with the newly drawn area in the same manner as complex ROI creation.

If you want to remove an ROI, activate it first by clicking the left mouse button in any point of the ROI. As a result the ROI contour (or contours if ROI consists of several areas) will be displayed as an animated line. Then use the **Edit➢Delete** menu command or press the [DELETE] key on the keyboard. You can also remove the ROI from your image using the **Edit➢Delete All...** menu command.

If you want to move an ROI on the image, you need to activate it first. After that, press the left mouse button in any point of ROI and, holding the button down, drag the ROI to the desired position on the image.

The program uses an image ROI to duplicate a part of the active image. This operation is named Crop, and it is available only in Image View when an ROI exists on the image. When you choose the **Image➢Crop ROI** command the program will generate a new copy of the active image ROI in a new window. The new image will contain an image made up of the pixels contained within the ROI's bounding rectangle. The duplicate image will have the same pixel depth, color model, and logical resolution as the image from which it was created.

The program allows you to copy the ROI contents of the active image to the Windows Clipboard. You can do it by choosing the **Edit➢Copy** command or by pressing the [CTRL] + [C] shortcut key on the keyboard. The copied ROI can be pasted into the active image using the **Edit➢Paste** command. You can do the same by pressing the [CTRL] + [V] shortcut key on the keyboard. When you paste a copied ROI into an active image in the program, the ROI content is not pasted, only ROI itself is pasted. If you need to paste a new image from the Clipboard, you have to use the **Edit➢Paste New** command. You also can create a new image from the Clipboard using the **Edit➢Paste new** command.

Resizing images

Use the **Image➤Resize...** command to create a new copy of your image at a specified size and replace the original image by this new copy. This process actually changes spatial resolution by adding (replicating) or removing (decimating) pixels to achieve the specified dimensions. The bilinear scaling technique is applied to reduce jagged edges. After you choose this command the "**Resize**" dialog box will appear.

An example of the "**Resize**" dialog box is shown in **Figure 7.12.**

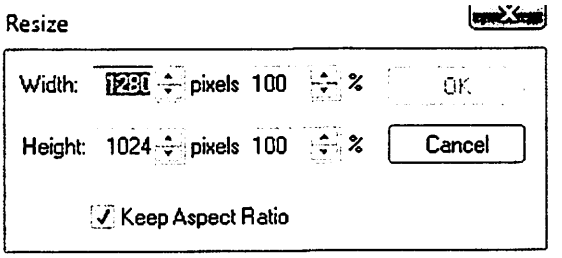


Figure 7.12. An example of the "**Resize**" dialog box.

This figure shows the following:

- Use the **Width** and **Height** selectors to scale the image to a specific height and width. You can specify new values in pixels or percent from the current value. If the **Keep Aspect Ratio** flag is not checked, you can set the height and width values independently, i.e., you can stretch or shrink the width without affecting the height, and vice versa.

- Clear the **Keep Aspect Ratio** flag if you need to set the **Width** and **Height** dimensions independently. Otherwise the **Height** and **Width** fields remain linked to maintain your image proportions. When one dimension is changed, the other is automatically adjusted to preserve the ratio between the height and width.

- Click the **OK** button to perform the image resizing. The program will resize the active image to the specified dimension, after that the dialog box is hidden.

- Click the **Cancel** button to break this command execution.

The program uses the bilinear scaling technique to resize an image. With bilinear scaling, adjacent pixels are evaluated and interpolated to produce smooth results. This operation may take some time, so while it is performing the **Status Bar** will display the progress indicator. You may break the operation at any moment by pressing the **[ESC]** button on the keyboard.

Rotating images

Use the set of **Image➤Rotate** commands to rotate an image to a specified angle.

The **Image➤Flip vertical** command reverses the position of the image in the application area, so that the top right corner of the original image is now the bottom right corner, and the top left corner of the original image is now the bottom left corner.

The **Image➤Flip horizontal** command reverses the image, so that the top right corner of the original image is now the top left one, and the top left corner of the original image is now the top right corner.

The **Image➤Rotate➤180** command turns the active image by 180 degrees.

The **Image➤Rotate➤ 90 CW** command turns the active image 90 degrees to the right (the clockwise direction).

The **Image➤Rotate➤90 CCW** command turns the active image 90 degrees to the left (the counterclockwise direction).

The **Image➤Rotate➤Arbitrary...** command allows you to turn the active image to the specified angle. It shows the "**Rotate arbitrary**" dialog box. You can find an example of this dialog in **Figure 7.13**.

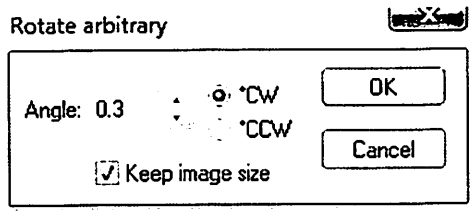


Figure 7.13. An example of the "**Rotate arbitrary**" dialog box.

This figure shows the following:

- You can specify the correct angle of rotation by typing in a number in the **Angle** edit box or using the spin buttons. The angle value must be from 0 to 359.99 degrees.
- The **CW** and **CCW** buttons allow you to choose the direction of rotation.
- The **Keep image size** flag lets you specify that the rotated image dimension (and size) must be the same as the original image.
- Click the **OK** button to perform the image rotating. The program will turn the active image to the specified angle. After that the dialog box will hide.
- Click the **Cancel** button to close the dialog box and keep the image untouched.

The image rotating operation may take some time, so while this operation is executing the **Status Bar** will display the progress indicator. You may break the operation at any moment by pressing the [ESC] button on the keyboard.

Split color images

The function **Image➤Split...** can be used for extracting one or several color channels from a color image. For each selected color channel a grayscale image is created. Desired color channels can be selected in the "**Split image into color panes**" dialog that appears after executing the **Image➤Split...** menu command. An example of this dialog is presented in **Figure 7.14**.

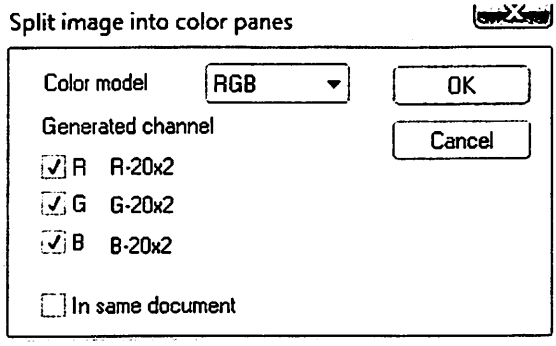


Figure 7.14. An example "**Split image into color panes**" dialog.

This figure shows the following:

- **Color model** allows you to select an appropriate color model with color channels you need.

- **Generated channels:** You can select one or more available color channels of a selected color model. For each selected channel new grayscale image will be created with a specified name near a color channel checkbox.

- **In same document:** This flag determines whether the generated channel images will be placed in the document with the source color image, or whether each channel image will be saved in its own document. Thus, if this flag is set you will get a sequence document.

Combine grayscale images

Image➤Combine color panes... is used to reverse the operation of splitting color images with **Image➤Split...** as described above. Thus from one or several grayscale images a new color image can be created. This function has a settings dialog, **"Combine,"** shown in **Figure 7.15.**

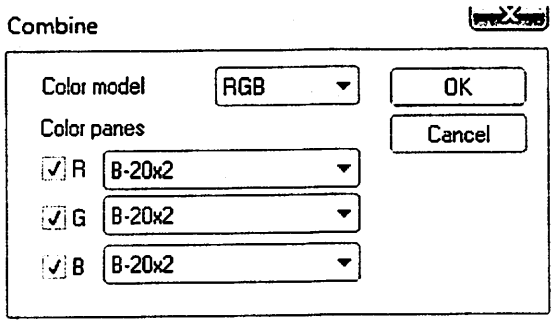


Figure 7.15. An example **"Combine"** dialog.

This figure shows the following:

- **Color model:** You can select the desired color model for an image that will be created as a result of combining grayscale images.

- **Color panes:** For each color channel, one currently-existent grayscale image can be chosen. It is possible to specify the same grayscale image for several channels. If you don't need to specify all channels, you can exclude some channel images by unchecking the corresponding check boxes. In this case, a pure black channel image will be used instead a real one.

Combine images

This function combines two color images into three modes—normal, RGB, and fluorescent. The combined image can be combined again to make another image. You need to choose more than two images on the Context window before performing this command. When it comes to an R, G, B combination, selecting more than three images is necessary. **Compare** command in here allows you to compare two images each other. For such a feature, selecting more than two images in the **Context window** is required before. Comparing images can be made by either mouse drag or keyboard arrow keys.

Apply Vectors to images

The **Image➤Apply vectors...** command makes already-drawn annotations, measurement objects, and manual measurement objects become permanent part of the image so that they cannot be changed later. Until you execute this command, your vector objects exist on a transparent overlay that is displayed on the top of your image.

Image➤Apply vectors... command is enabled only when at least one vector object exists in the active image. Once you start the **Image➤Apply vectors...** command, the drawing objects on the

overlay are permanently embedded into the image, and the image data is changed.

Working with image sequences

The **Image➢Sequence** popup menu contains commands that allow you to create a new image sequence and manipulate it with the active image sequence.

Sequence is a document with several images. A sequence can be saved only in files that support many entries. For example, a sequence can be saved in native program file format with img extension. You can transform it as video files as well in the form of avi, mpeg, and mov.

When any image of the sequence is activated, all images contained in the sequence are marked by a yellow frame in the Context window (**Figure 7.16**).

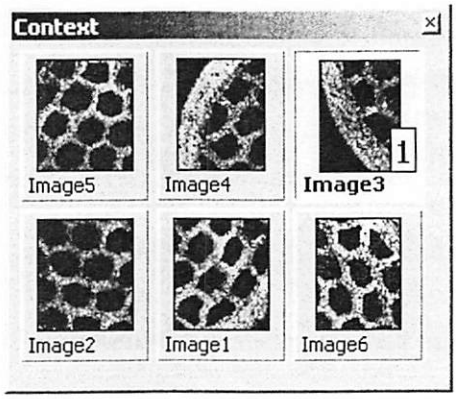


Figure 7.16. Active sequence in **Context window** (all images marked by yellow frames).

A sequence can be manipulated several ways:

- **Image➢Sequence➢Create new sequence:** Before executing this command it is necessary to select several images in the Context window that will contained in new sequence. You can choose the image by clicking the mouse with the [SHIFT]+ [Ctrl] keys.

- To delete an image from a sequence, use the **Image➢Sequence➢Remove frame** command. The current active image is removed from the sequence. This command is available only when the image sequence has more than one image.

- For step-by-step navigating between frames in a sequence, two commands are used: **Image➢Sequence➢Next frame** and **Image➢Sequence➢Previous frame.**

- Playing of the sequence is performed by **Image➢Sequence➢Play** forward and **Image➢Sequence➢Play** backward commands. If the **Image➢Sequence➢Play** repeatedly flag is set, playing will wrap around when the end of the sequence is reached. If this flag is not set, playing will be automatically stopped when edge frames (first or last) are reached.

Using an Image Histogram

Use the **Process➢Histogram** command to open the **Histogram** window and display the intensity histogram and statistics for the active image. A histogram shows a frequency distribution of the intensities in your image. It describes, in graphic form, the contrast and dynamic-range characteristics of your image. If you are not familiar with histograms, you may want to review Chapter 2 - Overview of Image processing.

If you select the **Process➢Histogram** command, the **Histogram** window will open.

Histogram window

The **Histogram** window is a "common access" window. It shows the histogram for an active image. After another image is activated, the contents of the **Histogram** window will be changed. The **Histogram** window remains open until you explicitly close it by choosing the **Process➢Histogram** command, or until you close all the images. You can find an example of the **Histogram** window in **Figure 7.17**.

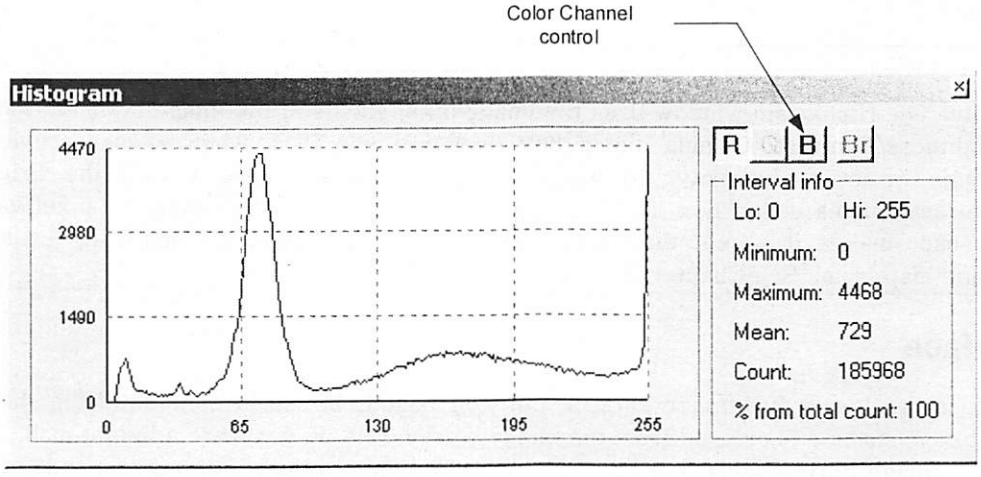


Figure 7.17. An example of the **Histogram** window.

The histogram X-axis is calibrated to the intensity unit. If the active image has 8 bits/color channel (True Color or grayscale 8 BPP images), the X-axis represents gray values from 0 to 255. Otherwise, if the active image has 16 bits/color channel (grayscale 16 BPP or color 48 BPP images), the X-axis will represent the intensity range from 0 to 65,535. The Y-axis is calibrated to the spatial unit-of-measure.

You can see any part of the histogram in more detail because it is possible to enlarge and focus on a particular area of the histogram. To do this, select the desired intensity range by clicking the left mouse button in the beginning of the range. Then, holding the left mouse button pressed, move the mouse cursor to the end of the desired range and release the button. After you select the intensity range, the X-axis will show only the specified range. Thus the histogram will be displayed enlarged. The statistical information will be updated also. Clicking the right mouse button returns the histogram to its original size.

When the active image is color, the **Histogram** window contains the **Color Channel** control. By using this control you can choose to see either the histogram of the image's combined luminosity or the histogram of its separate color channels (e.g., Red or Green or Blue, Hue or Saturation or Brightness). You can see the **Color channel** control in the right-top corner of the **Histogram** window as it is shown in **Figure 7.17**. This control contains four buttons: Red, Green, Blue and a button of combined Luminosity (or Brightness).

Below the **Color channel** control on the right side of the **Histogram** window you will find some statistical information about the displayed intensity interval, as follows:

- **Lo** field displays the lower interval limits.
- **Hi** field displays the high interval limits.
- **Minimum** field displays the minimum value of a histogram within the given intensity interval.
- **Maximum** field displays the maximum value of a histogram within the given intensity interval.

- **Mean** field displays the mean value of a histogram within the given intensity interval.
- **Count** field displays the sum of the histogram values within the given intensity interval.
- **% from total count** field displays the ratio of the sum of the histogram values within the given intensity interval (from **Lo** to **Hi**) to the total sum of the histogram values. This value is represented in percent. Note that this value is calculated for the currently selected color channel.

Note: The Histogram window uses the image pixel values of the image bitmap. That is, the **Brightness/Contrast/ Gamma** dialog box does not use LUT when a user previews the change in image intensity, so when the user modifies images with the **Brightness/ Contrast/Gamma** dialog box, the histogram does not accept the change in pixel values. If the user makes it accept the change, the histogram window automatically updates the image histogram. See Chapter 8 - Process.

3D surface

The surface rendering function creates a polygon-based, 3D surface model from the planar image. The 3D surface is created from the image's grayscale as if it were a height map. A bright area of the image corresponds to a hill in the 3D plot, while a dark area corresponds to valley. The original image colors are used as surface texture. The user interface described below provides wide capability to control visualization of the 3D model.

Image➢Show 3D surface... menu command has to be used to create a 3D surface model of the active image. After you choose this command, the "**3D surface**" dialog box will appear. An example of this dialog is shown in **Figure 7.18**.

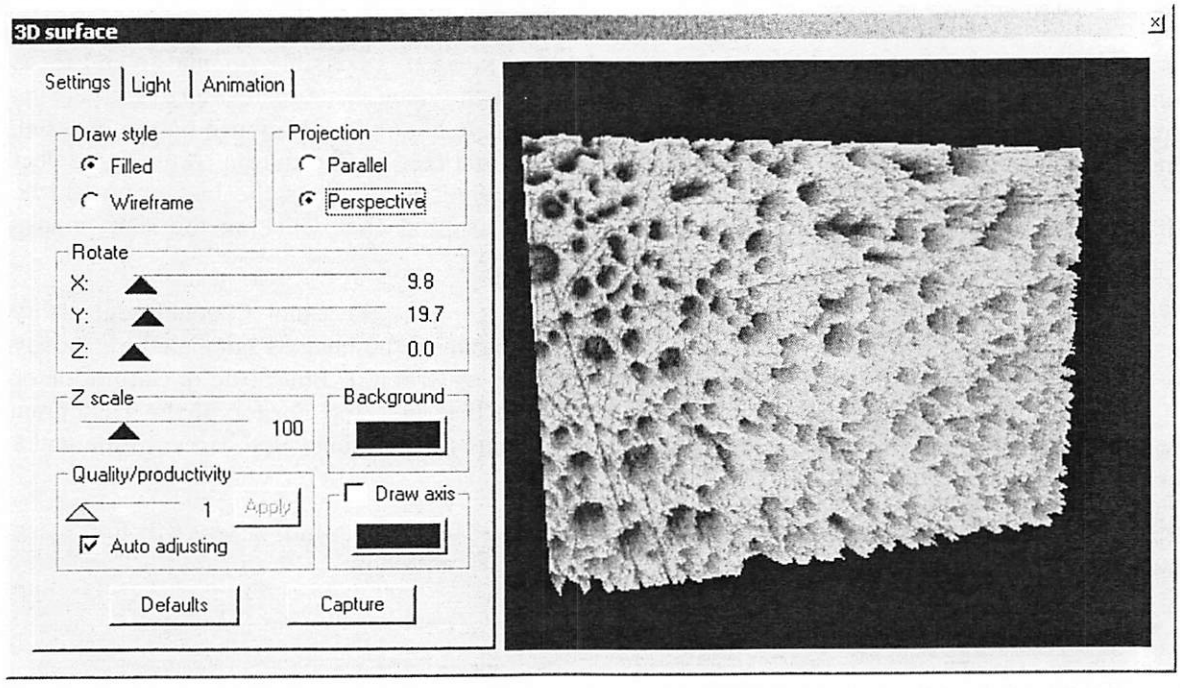


Figure 7.18. An example of the "3D surface" dialog box.

This dialog box consists of two major areas: tabbed pages with user controls, and 3D plot view. There are three control pages available are common setting, parameters of the additional directed light, and animation settings.

Tip: "3D surface" dialog box is resizable, so it is possible to have a bigger field of view for the 3D plot.

Figure 7.19 shows an example of a control page with the main settings of the 3D plot.

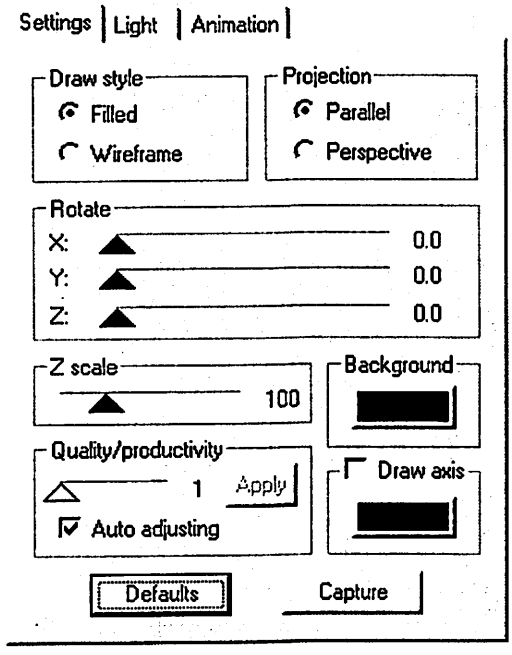


Figure 7.19. An example of the 3D surface "**Settings**" tab.

This figure shows the following:

- **Draw style** group allows choosing the approach to surface-plot filling, either a solid filled surface or a wire-framed surface consisting of lots empty rectangles. Study **Figure 7.20** to see the difference between these two modes.

- **Projection** group allows selecting the desired method of 3D plot depth visualization. Two types of projections are available: orthographic (parallel) and central (perspective).

- **Rotate** group is intended for 360-degrees rotation of the surface. All three axes of the 3D space are accessible independently.

- **Z scale** group allows changing the deepness of the 3D scene measured in percent. 100% scale corresponds to the original image height map proportions.

Note: Using less than 100% "**Z scale**" together with additional lighting switched on may cause a decrease of the graphic system productivity.

- **Background** control lets you specify the background color of the 3D plot view.

- **Quality/productivity** group select the appropriate quality of the 3D mesh in contrast to graphic system productivity. With finest quality, all pixels of the original image are presented in the 3D scene, i.e. the number of the 3D mesh nodes is equal to the number of the planar image pixels. With coarser quality, some pixels (rows and columns of the image) are omitted, so the 3D mesh contains smaller amount of nodes and thereby becomes simpler. Four adjacent mesh nodes create a polygon that is the basis of 3D plot creation. A big image

provides a huge number of tiny polygons, which compose the entire 3D surface. It may result in low operation speed (depending on computer hardware). On the other hand, fine details are not so necessary for big images, because they sometimes cannot be visually perceived. So it is reasonable to lose some fine details in exchange for better system productivity.

With help of the **Figure 7.20** you can see the difference between fine and coarse representations of the same 3D surface (images are zoomed in for better observation). To customize the quality/productivity setting, first switch off the **"Auto adjusting"** key. Desired quality may be chosen by the slider control. A low value corresponds to fine 3D mesh details. The **"Apply"** button has to be used to recalculate the 3D scene with new quality resolution. The **"Auto adjusting"** flag is used to automatically decrease quality for relatively big images, and to select the finest quality for relatively small images. This flag works well with most present-day video hardware that supports 3D acceleration.

- **Draw axis** group allows you to switch on/off the axes display and to select the appropriate color for them.

- **Defaults** button loads presets for this settings page.

- **Capture** button makes a snapshot of the current 3D scene and transfers the resulting 2D image to the program. A newly created image becomes active in the program, so the 3D surface will be refreshed to represent this new image.

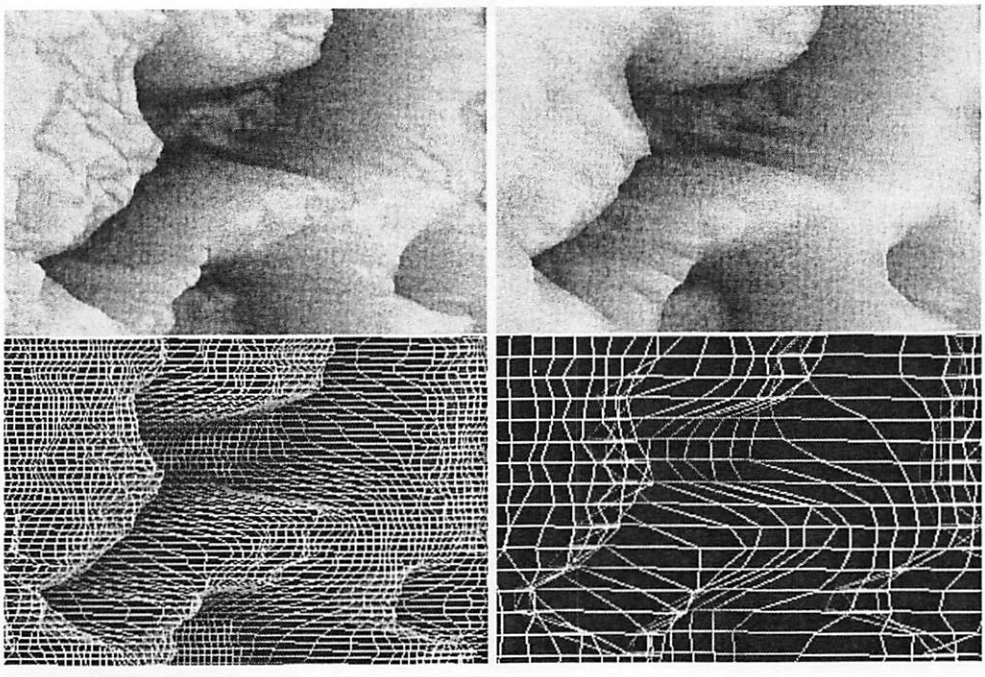


Figure 7.20. Same piece of the 3D plot with fine (left column) and coarse (right column) mesh quality, using filled (top row) and wire-framed (bottom row) surface representation.

By default the 3D scene is illuminated by dispersed light, like daylight in a room, without direct sun. To see more details in the 3D scene you can switch on an additional light like an electric lamp. This is a directed narrow beam of light. For example, with the help of this additional light, it is possible to distinguish minor knobs at the bottom of the deep valley on the 3D scene.

Figure 7.21 shows an example of the control page with light settings for the 3D plot.

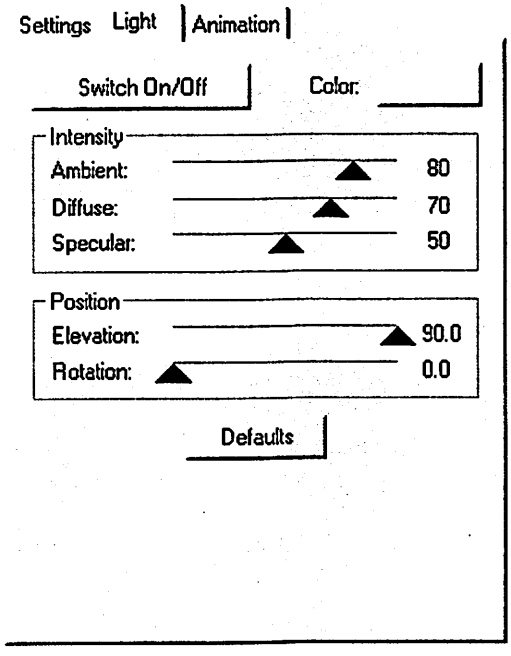


Figure 7.21. An example of the 3D surface "**Light**" tab.

This figure shows the following:

- **Switch On/Off** control enables/disables an additional directed light source in the 3D scene.
- **Color** control allows choosing color of the light.
- **Intensity** group contains controls that allow setup of *ambient*, *diffuse*, and *specular* parameters of the light source.
- **Position** group provides an ability to change the light source location, according to the plot surface. "**Elevation**" control determines the angle between the image plane and the beam of the light. Ninety degrees elevation is like the sun at the zenith (at noon), with few shadows. Smaller degrees of elevation cause more shadows to appear in the 3D scene. "**Rotation**" control determines the position of the light source around the center of the image. Zero degrees rotation corresponds to the direction of east; ninety degrees corresponds to the direction of north, and so on.
- **Defaults** button loads presets for this settings page.

The program can display animated rotation of the 3D surface. The animation process consists of the following steps: draw the surface plot rotated in the 3D space by the current selected angles (see "**Rotate**" group at the "**Settings**" page above); wait for some time; increment angles by some value; draw again with new angles; then repeat. To manage the animation process, a special control page is used, as shown in the **Figure 7.22.**

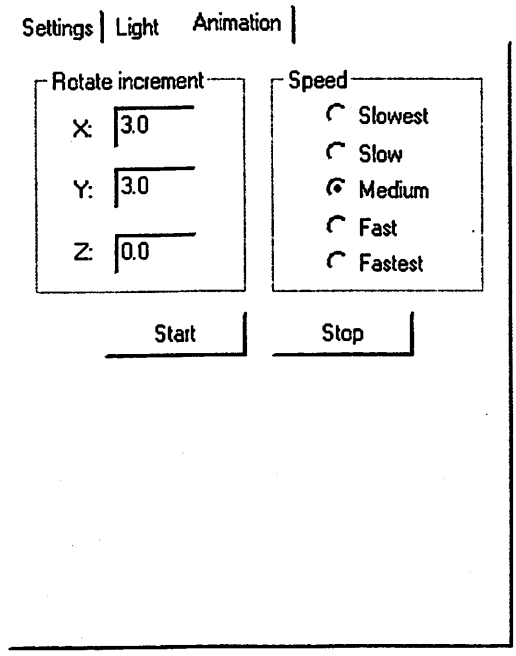


Figure 7.22. An example of the 3D surface "**Animation**" tab.

This figure shows the following:

- **Rotate increment** group contains three controls to set up three-dimension angle increment for producing a constant rotation of the 3D surface. Angle increments are measured in degrees. They can be negative for rotating in both directions. These values can be changed on the fly while existing animation is in progress.
- **Speed** group allows choosing the desired animation speed by setting the time delay between adjacent frames of the animation process.
- **Start** button begins animation, if at least one rotation increment value is not zero.
- **Stop** button allows the animation to finish.

Mouse manipulation

There are several useful actions with 3D surface that are available via the mouse in addition to the controls on the setting pages. Some actions are possible only with the aid of a mouse, such as surface translations by all axes.

Mouse control sequence	Effect on the 3D scene
Left button dragging	Rotate surface by X and Y axes
Left button dragging with [CTRL] key pressed	Rotate surface by Z axis
Left button dragging with [SHIFT] key pressed	Translate (shift) surface by X and Y axes
Right button dragging or rotating of the mouse wheel	Translate (shift) surface by Z axis to/from the observer (in other words – zooming)
Left button down, small mouse move to the desired direction, left button up together with some acceleration of mouse moving	Start animation with X and Y angle increment determined by direction and acceleration of the mouse move
Left button click	Stop animation

Left button double click	Reset all-axes rotations and translations to the default state

Chapter 8 - Process

Spatial Filtering

Filtering operations are used for image modification. They reduce or increase the rate of change that occurs in the intensity transitions within an image. Areas in which there are sudden or rapid changes in intensity appear as hard edges in an image. Areas where there are gradual changes produce soft edges.

Filtering acts to detect and modify the rate of change at these edges. It can increase the intensity differences in a soft edge to make it sharper, or reduce the intensity differences in a hard edge to smooth and soften it.

All the filters are applied to the whole image or to the image ROI.

The program provides an extensive set of filters that is divided into four groups:

- Edge
- Enhance
- Morphology
- Special

When you select the **Process➢Filters...** menu command, the "**Image Enhancement**" tab dialog is opened. Each group of filters has its own tab, where you select the type of filter you want to use. You can also change settings for the selected filter there. Filtered results can be represented in the active image as well as in a new image. You may use the **Edit➢Undo** command if you want to remove the effects of the filter you have applied.

The "**Image Enhancement**" dialog will be displayed until you close it by clicking the **Close** button on this window or by choosing the **Process➢Filters...** menu command. An example of the "**Image Enhancement**" tab dialog is shown in **Figure 8.1**.

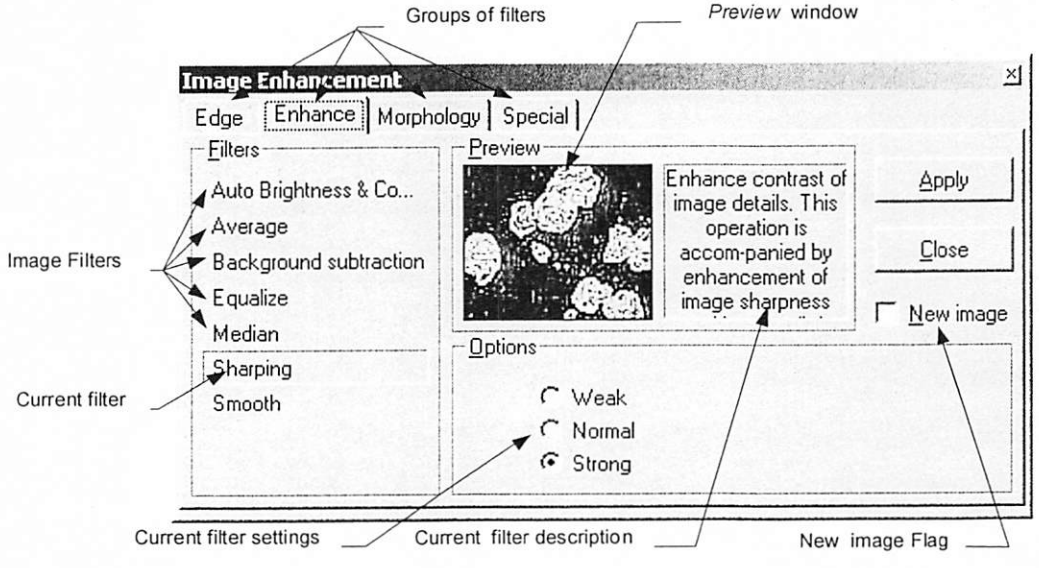


Figure 8.1. The "Image Enhancement" tab dialog.

At the top of the dialog there are tabs that contain the filter group names: **Edge**, **Enhance**,

Morphology, and **Special**. You can choose one of them by the left mouse button click. You can also use the shortcut keys [CTRL] + [TAB] and [SHIFT] + [CTRL] + [TAB] to move through them forward and backward correspondingly.

The **Filters** box contains filters from the group you have chosen. A frame looking like a pressed button marks the current filter.

The preview window occupies the left part of the Preview box. Here you can see the effects of a filter before it was applied to the active image. A brief description of the filter appears in the right part of the **Preview** box (on the right from the preview window).

To preview a filter, choose the desired filter from the **Filters** box. Filter preview will start automatically. If you change any option of a filter, preview will restart.

To view the desired part of the image, press the left mouse button inside the preview window and scroll the cursor around inside the preview window to see different areas of the image. After you release the left mouse button the visible part of the image will be previewed automatically.

Another way to view the desired part of an image is to press down the right mouse button inside the preview window. The mouse pointer will take the form of a hand. The preview window will display the active image thumbnail and a white frame that represents the preview area of the active image, as shown in **Figure 8.2**. You can choose different areas of the image by moving the white frame inside the thumbnail. You can do it by moving the mouse and holding down the right mouse button. After you release the right mouse button the desired image area will be displayed in the preview window and preview will restart.

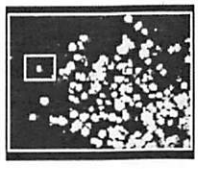


Figure 8.2. The Preview window with the area chosen.

The **Options** group box contents will vary depending on the kind of filter you have selected. The options for each filter are described below.

You can apply the specified filter by clicking the **Apply** button. Before clicking this button, be sure you have selected the filter you want to use, and have set the filter options that you need. Be sure to select the filter group first, because the group of filters selected determines your choices.

Filtered results are almost always written to the active image. If you want to keep the active image untouched you can set the **New image** flag. This flag means that the filtered result will be a new image.

Click the **Close** button when you have finished working with the filters.

Below you will find a description of each of the filter groups.

Edge filters tab

Filters of this class detect edges of areas in an image by extracting a high-frequency component of the image, or by calculating the first or second derivative. The edge enhancement operations extract all of the edges in an image, regardless of direction. The resulting image appears as an outline of the objects in the original image. Constant brightness regions become black, while changing brightness regions become highlighted.
There are the following edge filters:

- Gradient
- Kircsh
- Laplase
- Sobel
- Variance

Options group box of the **"Image Enhancement"** tab dialog contains the **Add to source** flag for all Edge filters (see **Figure 8.3**). If this flag is set, the filtered results will be combined with the untouched initial image. As a result, you will get the effect of sharpness enhancement of the initial image. This flag is available for all edge filters.

The **Options** group also shows the **Mask size** group box. This option allows you to choose a filter's kernel size, which sets its neighborhood size. This option is available only for the **Laplase** and **Sobel** filters. For the rest of edge filters the **Mask size** group box is invisible.

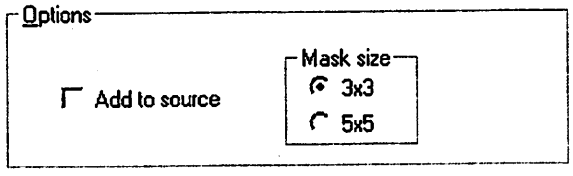


Figure 8.3. The Edge filters options.

Gradient

Gradients are calculated from a pair of convolution operations. One convolution kernel responds maximally to a vertical edge, and the other to a horizontal edge. Gradient magnitude is calculated as the square root of the sum of squares of the results of the two mask overlays.

The borders enhanced by this filter are clearer, more even, and unbroken compared to the **Laplase** filter.

Kircsh

The **Kircsh** filter calculates an approximation of the first derivative of the image data and is used as an edge detector. The filter gives thick, bright edges.

Laplase

A Laplace operator is calculated from the image pixel values by using finite differences.
The **Laplacian** is the 2D equivalent of the second derivative:

$$\nabla^2 f = \frac{\partial^2 f}{\partial x^2} + \frac{\partial^2 f}{\partial y^2}$$

The **Laplase** filter modifies each pixel value of an image to exaggerate its intensity difference from its neighbors. This filter produces harsh intensity transitions, and results in an image with edges of high contrast. The edges enhanced by this filter are clear, but usually dim and broken.

Select the **Laplase** filter if you want to enhance all the edges in an image.

Sobel

This filter extracts and enhances edges and contours in an image by expressing intensity differences (gradients) between neighboring pixels as an intensity value. The results of this filter are highlighted edges against a dark background. The **Sobel** filter gives thick edges.

Select this filter if you want to enhance just the principal edges in an image.

Variance

The **Variance** filter replaces each pixel with the standard deviation of its 3x3 neighborhood. The edges enhanced by this filter are less thick and bright than in the **Kirsch** filter.

Select this filter if you want to detect and emphasize edges and textures.

Enhance filters tab

Use this group of filters for preprocessing the images. It includes the following filters:

- Auto Brightness and contrast
- Average
- Background subtraction (Even or Flatten)
- Equalize
- Median
- Sharpening
- Smooth

Note: If your image appears black after applying any of the above filters, use your Brightness, Contrast, and Gamma controls to lighten the image and bring out the edge detail.

Auto Brightness and contrast

This filter redistributes pixel brightness by stretching the histogram of the original image. There are no additional options for this filter.

Average

Average filter replaces a pixel value by an average value of the neighborhood of 3x3 or 5x5 pixels, depending on the **Mask size** option in the **Options** group box (an example of the **Average** filter options is shown in **Figure 8.4**). Pixel values in the neighborhood are summed without being weighted, and the sum is divided by the number of pixels in the neighborhood.

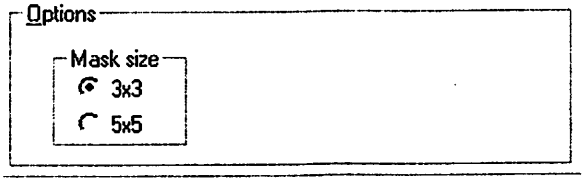


Figure 8.4. The Average filter and Smooth filter options.

Background subtraction

This filter for analysis breaks the image into squares with sides set by the **Mask size** option. **Figure 8.5** shows an example of the **Options** group box with the **Mask size** option. You can select a mask size from 15 to 45. In each square, a background value is defined, then the filter subtracts the background value within a mask from the original image brightness. As a result the intensity variations in the background pixels are reduced.

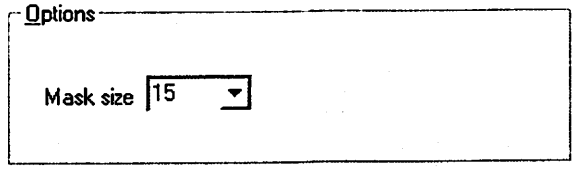


Figure 8.5 the Even filter options.

Equalize

This filter provides linear histogram equalization. Histogram equalization redistributes intensity values to "flatten" the frequency distribution. As a result, the quantity of points of each brightness value on the image is nearly equalized, and imperceptible elements on the original image become visible. Thus the dynamic range of the image extends. There are no additional options for this filter.

Median

Median filter replaces pixel values by the median value of the neighboring intensities in a 3x3 neighborhood. This filter is efficient in eliminating isolated strong spikes, like noise. There are no additional options for this filter.

Sharpening

Image sharpening allows high spatial frequencies to remain unchanged, but suppresses low frequencies. A high-pass filter has the effect of preserving sudden variations in intensity, such as those that occur at the boundaries of objects, but suppresses more gradual variations. It makes noise more prominent because noise has a strong high-frequency component.

This filter is a 3x3 convolution. There are three gradations of sharpness enhancement: **weak**, **normal**, and **strong**, as you can see in **Figure 8.6**.

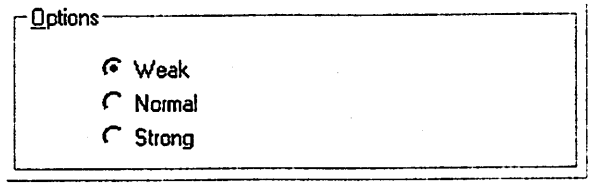


Figure 8.6. The Sharpening filter options.

Smooth

Image smoothing, or *low-pass* filtering, allows low spatial frequencies to remain unchanged, but suppresses high frequencies. A low-pass filter has the effect of smoothing or blurring the image, reducing noise but obscuring fine details. **Smooth** filter uses kernels depending on the **Mask size** settings in the **Options** group box (see **Figure 8.4**).

Morphological filters tab

Filters of this group work with images. These filters are morphological operations. There are the following morphological filters:

- Bottom hat
- Close
- Dilate
- Erode
- Open
- Top hat

All the above-listed filters have a parameter that allows you to set the size of pixel neighborhood subjected to morphological analysis. The **Options** group box of the Image Enhancement tab dialog contains the controls as you can see in **Figure 8.6**. With the help of these controls you can choose 4 or 8 neighbors.

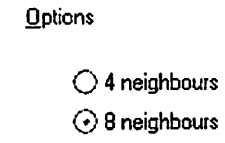


Figure 8.7. The Morphological filters options.

Bottom hat

This transformation allows one to detect the dark area of the image
First, ordinary "Close" morphology operation is applied. After it, original image is subtracted from the closing result. Result of this filter is revelation of small cavities on the black background

Close

This filter is a consecutive performance of **Dilate** and **Erode**. The effect is to smooth boundaries, to join narrow breaks, and to fill small holes caused by noise. It also connects disconnected objects.

Dilate

Morphological dilation expands or dilates a binary image. It shrinks the holes enclosed by a single region and makes the gaps between different regions smaller. It tends to fill in any small intrusions into a region's boundary.

Erode

Opposite to the operation of dilation, morphological erosion shrinks or erodes a binary image. It expands the holes enclosed by a single region and makes the gaps between different regions larger.

Open

This filter is a consecutive performance of the **Erode** and **Dilate** filters. The effect is to smooth boundaries, to break narrow isthmuses, and to eliminate small noise regions. This filter separates connected objects and removes small objects.

Top hat

First, ordinary "Open" morphology operation is applied. After it, original image is subtracted from the opening result. So, this filter has the same sense of Bottom hat, but it works with saliences rather than cavities

Special filters tab

Emboss

This filter replaces an image with a 3D lifted/depressed-face relief based on pixel brightness.

Negative

Use this filter to get an inverting image.

Image Enhancement

Intensity modifying

You can use the **Process➢Brightness/Contrast...** command to adjust the brightness, contrast, and gamma settings for an active image. You can change these settings and apply them to the **Luminance** channel, or to **Red**, **Blue**, and **Green** color channels separately. When you choose the **Process➢Brightness/Contrast...** command the "**Brightness/Contrast/Gamma**" dialog box will appear. The controls on this dialog allow you to change the brightness, contrast and gamma for an active image in different ways. You can find an example of this dialog in **Figure 8.8**.

Lookup Table

The "**Brightness/Contrast/Gamma**" dialog uses the image Lookup Table (LUT) to preview the image modification in the image window. This means the pixel values in your image bitmap are not actually modified until you apply the changed settings to the image. The controls modify the image LUT that defines how each pixel value is interpreted. For example, when you increase brightness in an image, all of the intensity values in your image are increased by a certain amount, as you can see in the image window. The pixel values in your image are not actually changed. The changes you see on the screen are calculated by reading the image original value and processing it through the LUT.

There are two reasons the program uses LUT for processing intensity enhancements:

1. It is the fastest way to apply multiple adjustments to an image.
2. It lets you easily reverse adjustments you have made.

As shown in **Figure 8.8.**, the "**Brightness/Contrast/Gamma**" dialog box contains three sliders that allow you to modify image brightness, contrast, and gamma.

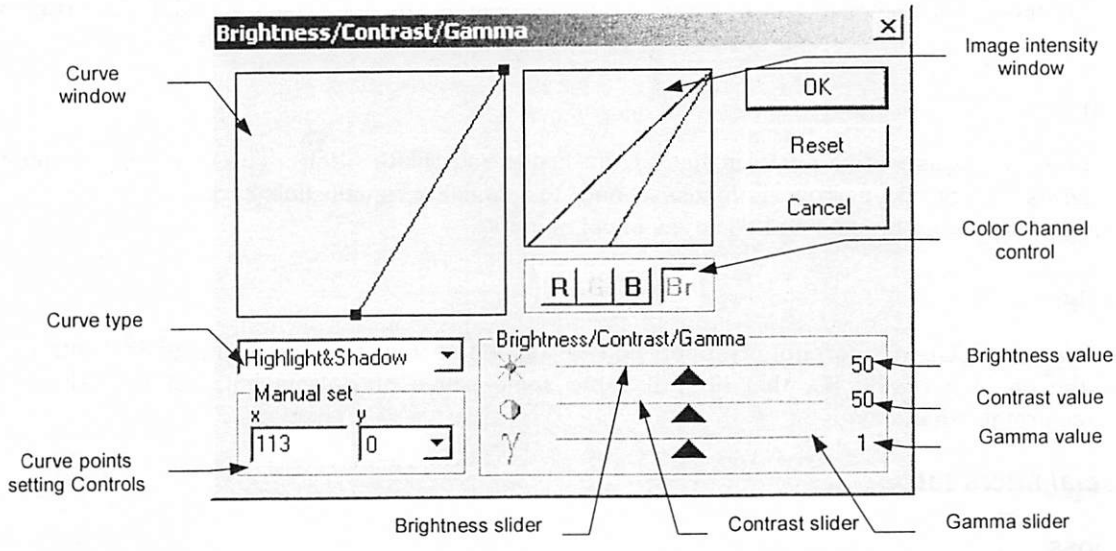


Figure 8.8. An example of the "**Brightness/Contrast/Gamma**" dialog box.

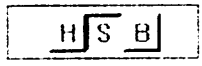
Color Channel controls

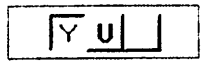
The following controls are used to adjust the visual qualities of your image. The **Color Channel** control looks different depending on the color model of your image:

- **Grayscale:** Only one **Brightness** channel can exist for grayscale images, so

the **Color Channel Selector** looks empty.

- RGB: Select the **Luminance, Red, Green,** or **Blue** channel button corresponding to the color in your image. The **Brightness** channel is the intensity produced by the combined **RGB** channels.

-  HSB: Select the **Hue, Saturation** or **Brightness** channel button corresponding to the color component in your image.

-  YUV: Select the **Y, U** or **V** channel button corresponding to the color component in your image.

Click on the color button, and move the slider controls until the new color values are reflected in your image.

Sliders

There are three independent slider controls for each characteristic:

- Move the **Brightness** slider to the right to increase the image brightness, or to the left to decrease it. On the right of this slider the current brightness value is shown. Using this slider you can change the value from 0 to 100. Value 50 means that the brightness value remains unchanged.

- Move the **Contrast** slider to the right to increase the image contrast, or to the left to decrease it. On the right of this slider the current contrast value is shown. Using this slider you can change the value from 0 to 100. Value 50 means that the contrast value remains unchanged.

- Move the **Gamma** slider to the right to increase the Gamma value (increase dark area contrast), or to the left to decrease it (increase bright area contrast). On the right of this slider the current Gamma value is shown. Using this slider you can change the value from 0.1 to 9.8. Value 1 means that the contrast value remains unchanged.

Image Intensity

The **Image Intensity** window gives you visual feedback during intensity changing. This field shows the intensity curves for all color channels of the active image, i.e. this window always shows the final LUT.

Curve window

This window lets you modify the LUT, giving you more control over the results. Using this control you can reshape the Intensity Response Curve that describes your intensity scale. Initially, the values on your scale are linearly distributed from its smallest value to its largest one. The **Curve** control is scaled to use values in a range that is defined by the bits/color channel value of your image (from 0 to 255 for grayscale 8 BPP and True Color images, from 0 to 65,535 for grayscale 16 BPP or color 48 BPP images).

Curve Type combo box

The **Curve Type** control allows you to select the intensity curve type. In this combo box, select the number of control points you need. When you select a curve type, the appropriate curve will be displayed in the **Curve** window. You can modify the curve shape by dragging the control point to a new position. When you drag the control point, its values are displayed in the **x** and **y** fields in the **Manual Set** group box. You will also see the results of change immediately in your image. If you want to undo the curve changes you have made, use the **Reset** button. To write the changes permanently to your image, click the **OK** button. The following curve types are provided:

- The **Highlight & Shadow** option lets you modify the curve using two control points: the **Highlight** point (the largest value on the scale) and the **Shadow** point (the smallest value on the scale). Both these control points can be moved in a horizontal direction only.
  - The **Highlight** point specifies a point at which all values to the right of this point are set to the highest value on your scale (white or 255 if you are working with a grayscale 8 BPP image).
  - The **Shadow** point defines the point at which all values to the left are set to the smallest value on your scale (black or 0 if you are working with a grayscale 8 BPP image).

- The **1/4 Tone** option lets you modify the curve using 5 control points. It allows you to change the shape of the curve in 4 segments. All these points can be moved in a vertical direction only. You need to move the control point upward to increase the intensity value of that point and the points along the segments it touches. Moving a control point downward decreases the intensity value of that point and the points along the segments it touches.

- The **1/8 Tone** option allows you to modify the curve using 9 control points. The curve shape consists of 8 segments. All control points can be moved in a vertical direction only. You need to move the control point upward to increase the intensity value of that point and the points along the segments it touches. Moving a control point downward decreases the intensity value of that point and the points along the segments it touches.

- The **Composite** option allows you to specify directly all elements of the selected color channel of LUT. You can do it by changing the response curve shape in the **Curve** window using the mouse. A pixel with a particular intensity value (X-axis) will receive a certain output value (Y axis) as a result. The **Composite** option allows you to get the most detailed control over the LUT.

Note: Unlike the other options in the **Curve Type** combo box, when the **Composite** option is chosen the **Curve** window shows the final LUT changes.

Manual Set

The **Manual Set** group box shows the input (**x**) and output (**y**) values of the cursor in the **Curve** window. You may change these values by using the **x** and **y** controls, as follows:

- If the **Highlight & Shadow** option is chosen in the **Curve Type** control, the **y** control contains the output values of the **Highlight** and **Shadow** control points. You can change the input value for each of these points by typing it in the **x** control and pressing **[ENTER]** key on the keyboard.

- If the **1/4 Tone** or **1/8 Tone** option is chosen in the **Curve Type** control, the **x** control

contains the input values of all curve control points. You can change the output value for each of these points by typing it in the **y** control and pressing the **[ENTER]** key on the keyboard.

- If the **Composite** option is chosen in the **Curve Type** control, the **x** and **y** controls contains the input and output values of the last dragged curve point. By using these controls you can change any curve point values.

Click the **Reset** button to restore the LUT to the initial linear state. You will see all controls returned to their initial, flat positions.

When contrast modifications are performed, all changes are placed into the image LUT, so you may want to close the dialog box to continue working with your image. To apply changes to the image click the **OK** button. After the **"Brightness/Contrast/Gamma"** dialog box is closed the image LUT will be destroyed.

Click the **OK** button to close the **"Brightness/Contrast/Gamma"** dialog box and make the LUT enhancements permanent. The modified pixel values will be written to your image bitmap.

Click the **Cancel** button to close the **"Brightness/Contrast/Gamma"** dialog box and keep the image untouched.

Pseudo-coloring images

You can use the **Process≫Pseudo-color...** command to "colorize" an active grayscale image (grayscale 8 BPP or grayscale 16 BPP). With its help you can highlight certain features in a grayscale image. You can also use it to increase specific intensities that are difficult to distinguish from their surroundings. For example, for features with pixel values 128 it will be impossible to see a gray tone image in a field of pixels with similar values, but if that value is changed in color it will stand out.

Figure 8.9a shows the image with uneven background. It is difficult to determine that the right side of the image is darker than the left one.

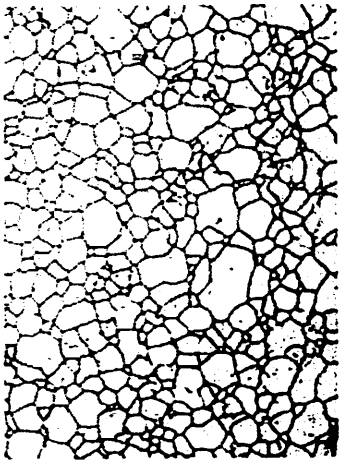


Figure 8.9a. The source image.

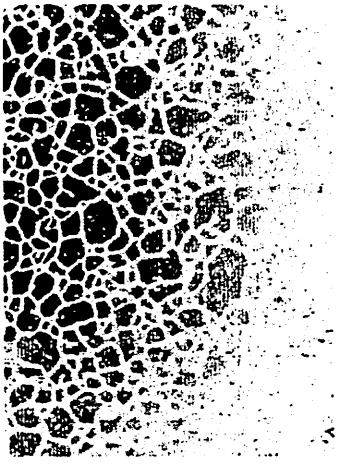


Figure 8.9.b. The pseudo-colored image.

Figure 8.9b shows the same pseudo-colored image. In this image you can easily see a difference between colors on the right side of the image and its left side.

When you pseudo-color a grayscale image you do not alter the pixel values in your image bitmap. You build a *palette* through which your image is displayed. This pseudo-color palette is associated with a pseudo-colored image that translates the gray-level values in the image as

color. The pseudo-color palette associated with a pseudo-colored image is not a permanent part of the image. It is a palette that you assign to the image while you work with it in the program.

Note: As the **Process ➢Pseudo-color...** command concerns grayscale images only, it will be disabled if a color image is active. If you want to pseudo-color a color image, you must first convert it into a grayscale one.

The **Process➢Pseudo-color...** command shows the "**Pseudo-color for Gray** " dialog box. You can find an example of this dialog in **Figure 8.10**. The "**Pseudo-color for Gray** " dialog box contains tools that allow you to build pseudo-color palettes for grayscale images.

The sequence of operations you need to perform to pseudo-color the active grayscale image is the following:

1. **Specify the range of intensities** you want to pseudo-color. The intensity range is specified using the **Lo** and **Hi** controls.
2. **Specify the number of distinct colors** you want to associate with the selected intensity range. The number of colors is selected using the **Level** control. When you set **Level** to a number different from 0, the **Color bar** and your image assume pseudo-color settings by default. The **Color bar** represents the entire intensity range and illustrates the portion that is being colorized.
3. **Change the color assignments.** This is done using the color buttons on the **Color map, Color bar** controls, and the **Original Color** and **Mapped Color** buttons.

After you finish specifying the pseudo-color palette, click the **OK** button on the "**Pseudo-color for Gray**" dialog box to assign the palette to the active image. Your image will be displayed using this palette for as long as your image remains open. If you want the pseudo-colored image to return to its normal grayscale state, you need to select the **Process➢Pseudo-color...** command and click the **Reset** button on the "**Pseudo-color for Gray**" dialog box. After that you can close this dialog.

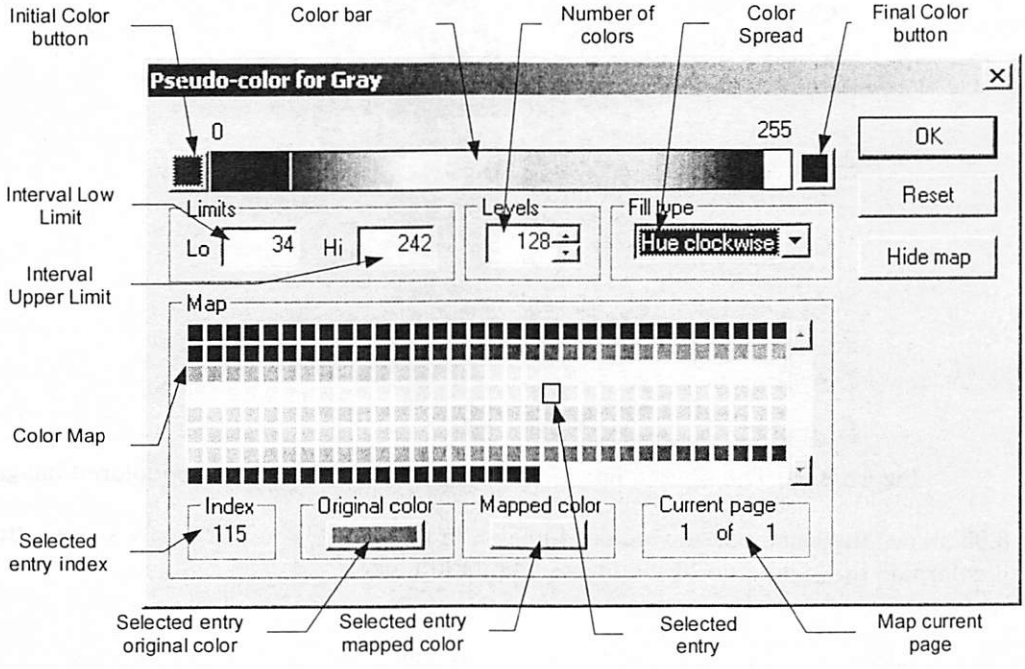


Figure 8.10. An example of the "Pseudo-color for Gray" dialog box.

This figure shows the following elements:

- The **Initial color** button lets you choose the initial color for the **Color bar**.
- The **Final color** button lets you choose the final color for the **Color bar**.
- The **Color bar** control represents the entire intensity range. It also illustrates the portion of the intensity range that is being colorized. You can find the intensity low limit on the left and above the **Color bar**. On the right and above the **Color bar** the intensity upper limit is shown. These limits take values 0 and 255 for 8 bits/-per-channel images, or 0 and 65,535 for 16 bit-per-channel ones. Clicking the left mouse button can change the limits of the current interval.
- The **Limits** group box and the **Level** control box allow you to choose the intensity range and the number of distinct colors you want to use for pseudo-coloring. The program will divide the specified intensity range into the number of intervals you specify by using the **Level** control, and assign a default color to each interval. The color intervals are displayed in the **Color bar** control. Changing the number of divisions will divide the range into equal numbers of intensities. Individual controls are:
  - The **Lo** control lets you specify the intensity value that is the lowest one you want to colorize. If you select the number of colors, the **Color bar** will reflect the change. You can also change this limit by dragging the left end of the colorized part of the **Color bar**.
  - The **Hi** control lets you specify the intensity value that is the highest one you want to colorize. If you have selected the number of colors, the **Color bar** will reflect the change. You can also change this limit by dragging the right end of the colorized part of the **Color bar**.
  - The **Level** control lets you specify the number of distinct colors to be pseudo-colored. Your image and the **Color bar** respond this value changes. You can specify up to 255 divisions.
- The **Fill type** control allows you to change the predefined colors for the pseudo-color scale assignments. The following types of filling are provided:
  - The **Gradient** option lets you go directly across the **Hue** color wheel from the initial color to the final color without intermediate colors. For example, gradations from blue to red. The initial and final colors can be chosen using the **Initial color** button and the **Final color** button.
  - The **Hue clockwise** option lets you go around the **Hue** color wheel clockwise from the initial color to the final color. For example, you can go from blue to red through shades of magenta.
  - The **Hue anticlockwise** option lets you go around the **Hue** color wheel counter-clockwise from the initial color to the final color. For example, from blue to red you can go through shades of yellow and green.
- The **Color map** contains color cells. The cells cover the entire intensity range, and each cell represents a color. For grayscale 8 BPP images the number of cells is 256 (or one palette page). In this case the **Color map** contains all colors of the image. If your image is grayscale 16 BPP, the number of cells is 65,535, and the **Color map** contains 256 palette pages, but only one palette page can be visible. You can change the visible page using the scroll bar on the right side of the **Color map**. The current page number is displayed on the right of the **Color map** below it. Using the mouse you can choose the color cell and edit it with the help of the **Index**, **Original color**, and **Mapped color** buttons.

- The **Index** control represents the initial color value of the image (grayscale index). It takes values from 0 to 255 for grayscale 8 BPP images, or form 0 to 65,535 for grayscale 16 BPP images.

- The **Original color** button represents the same color as in the **Index** control item. It gives the visual representations of the initial color.

- The **Mapped color** button represents the color that is used in pseudo-coloring. You can change this color by clicking the button. Thus it is possible to change separate colors in the pseudo-coloring palette.

- The **Current page** field shows the current page of the **Color map**. If your image is grayscale 8 BPP, only one palette page can exist. For grayscale 16 BPP images, this field can display values from 1 to 256.

- Click the **OK** button to assign the palette to the active image and to close the dialog.

- Click the **Reset** button to return the pseudo-colored image to its initial grayscale state.

- Click the **Hide map** button to hide or show the **Color map** in the bottom part of the dialog.

Using multi-focus (focus enhancement) function

You can use the **Process≫Fast focus enhancement** menu command to combine several unfocused images into one sharp image. This operation is used if you have failed to bring all object parts into focus while capturing.

There are the several steps to get a sharp object image:

1. Acquire or open several images (2 or more) representing different focal distances to the object.

2. Select images to be used for summing.

3. Apply Fast focus enhancement. The program will combine selected images into a new one (**Figure 8.11**).

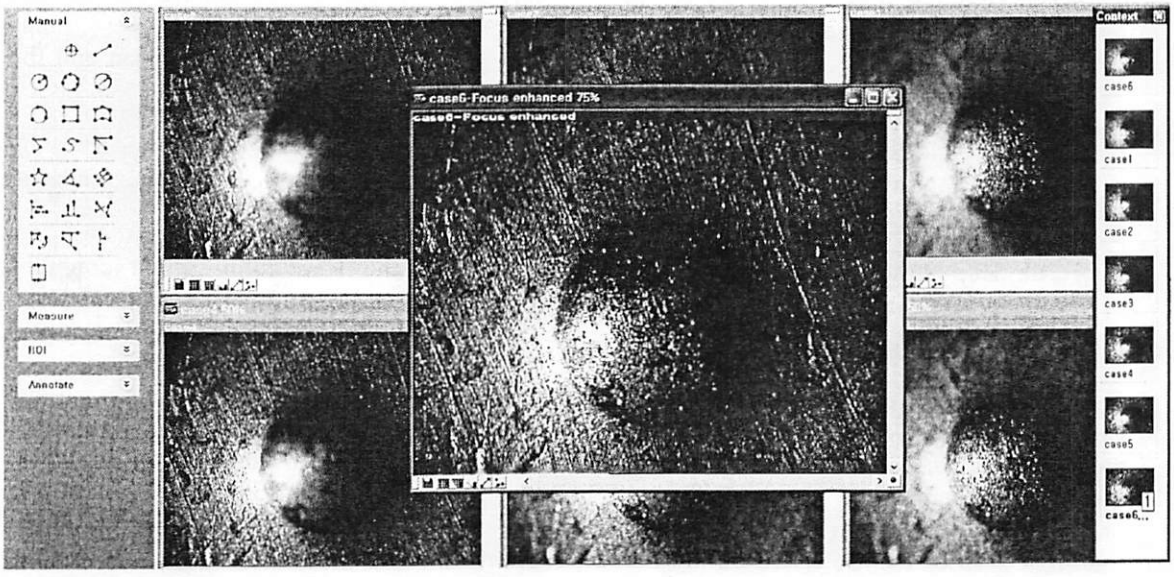


Figure 8.11. Result of Fast focus enhancement

The **Process➤Fast focus enhancement** operation may take some time, so while it is performing the **Status Bar** will display the progress indicator. You may break the operation at any moment by pressing the [ESC] button on the keyboard. . There is an option to close the source images after process in setting.

Displacement images

A stereomicroscope takes images with tilting due to its own structural characteristics. Thus, each image is out of its supposed position when you move the microscope to the Z-axis to calibrate the focus. This function allows you to rearrange these images.

To do this, first select a sequence of pictures in the Context window. Here, you must select them in the order of their direction. That is, you need to choose either upward or downward from the Z-axis and select the images by their directional order. After you select the images go to **Process➤Displacement images** and select Auto or Manual option. Auto operation shows you the work progress at the bottom of the window. There is no change to images until you finish the process. This is because the program remembers the rearranged value without showing it.

If you want a number of images, go to **Settings** and increase the value for **Max displacement**. This figure is the maximum pixel value to be calibrated. It can be up to 200. Basically, if you want to process more than 7 images, you need to make the figure over 30 (Default: 15). The higher figure requires more time.

In **Displacement settings**, the **Scan area size (% from image size)** control sets the size of the images the program scans to calibrate them. The figure below is set for only 30% of the image area to be scanned.

Scan direction means the direction of scanning; **Left-top** is from left to top, **Right-bottom** is from right to bottom, and **All** is for all directions.

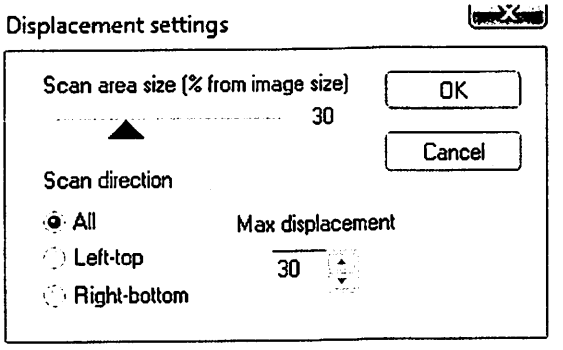


Figure 8.12. An example of **Displacement settings** dialog box.

Manual operation

The manual option in the **Process➤Displacement images** command changes pairs of images into black-and-white ones, in sequence. That is, the second image overlays on the first image, then the arrow keys on a keyboard (or Crtl+ arrow keys) allow you to match the second image to the first one. Press Enter to finish the process. Then the next image appears overlaid in the same way. The same process is repeated until the last image is modified, then all the images become color again. There is no change to the image itself, no matter what you choose – Auto or Manual. The program automatically remembers the modified values of the images. When the **Displacement images** command is over, perform the **Process➤Fast focus enhancement** command.

Now you will see a clear view with the calibrated images.

Shading Correction

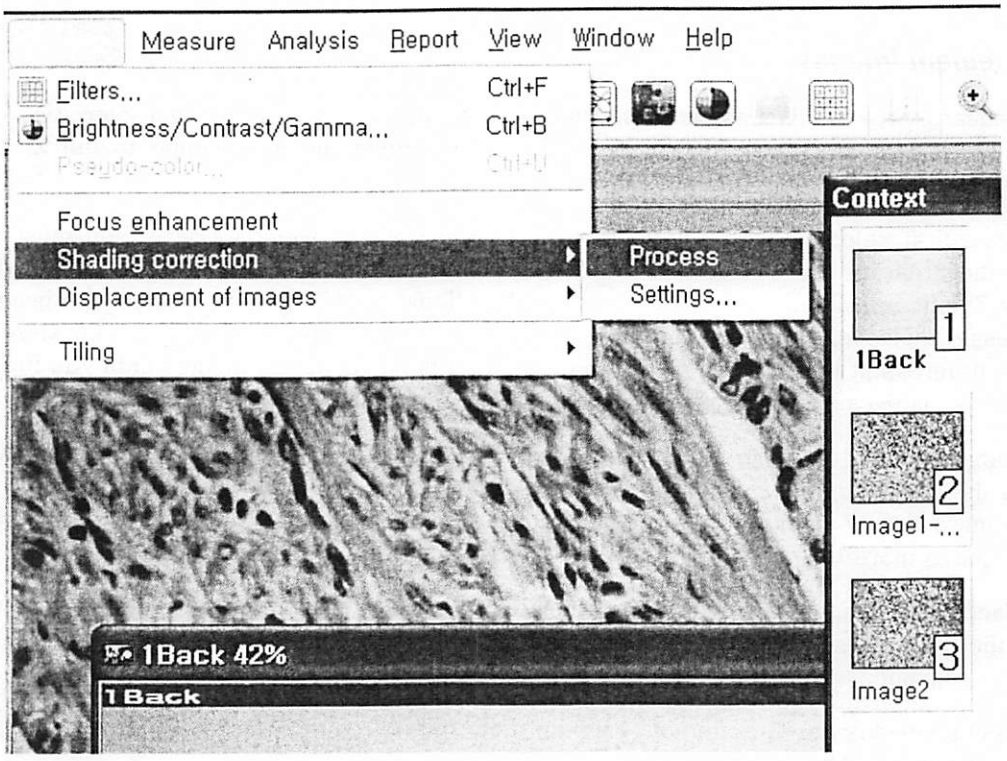


Figure 8.13. Example of the shading-correction process.

Acquire a standard image from a blank space on the slide glass, or from an out of focus image in a metallurgical specimen. The first image selected in the Context Window is treated as the background. The remaining images will be corrected against this image.

Under **Process ➢Shading Correction** choose **Process** to correct the background shading of all selected images. When the **New Image** option is checked in **Process ➢Filters**, the corrected images will appear as new ones in the Context Window.

Brightness in the resulting images can be altered in **Process ➢Shading Correction ➢Settings**.

Image tiling

Tiling is a very useful function when you need to create a high-resolution image of a big object with an area that exceeds the frame borders captured by the camera. If it is not desirable to decrease the magnification and miss some small important details, the tiling function helps to join several overlapped images acquired in series.

Tiling can work only with mutually overlapped images that have common areas (overlays).

Figure 8.14 shows an example of the two overlapped images you can see in the tiling operation.

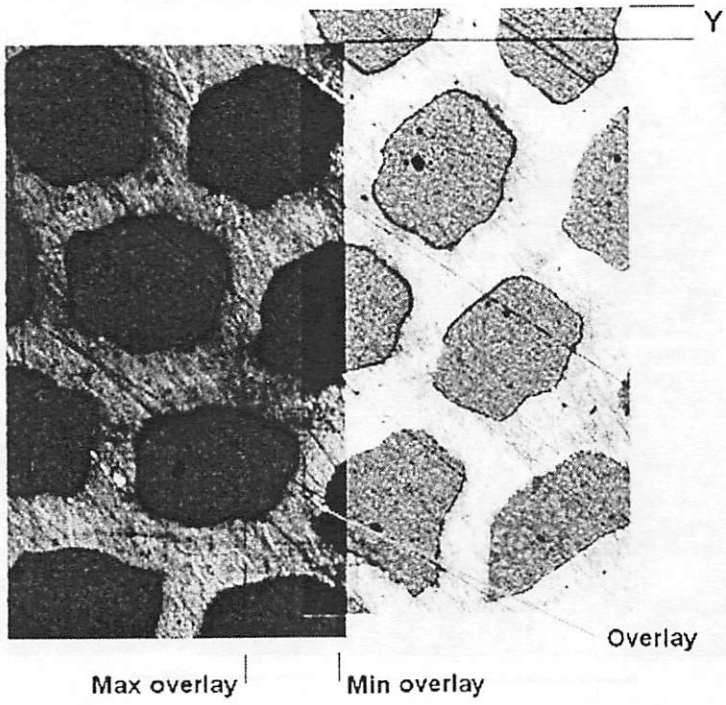


Figure 8.14. Overlapped images for tiling.

For good performance of the tiling function it is recommended to have some typical details of the images in the zone of overlay. For example, let's consider producing from several pieces a complete image of the original big object in Figure 8.15.

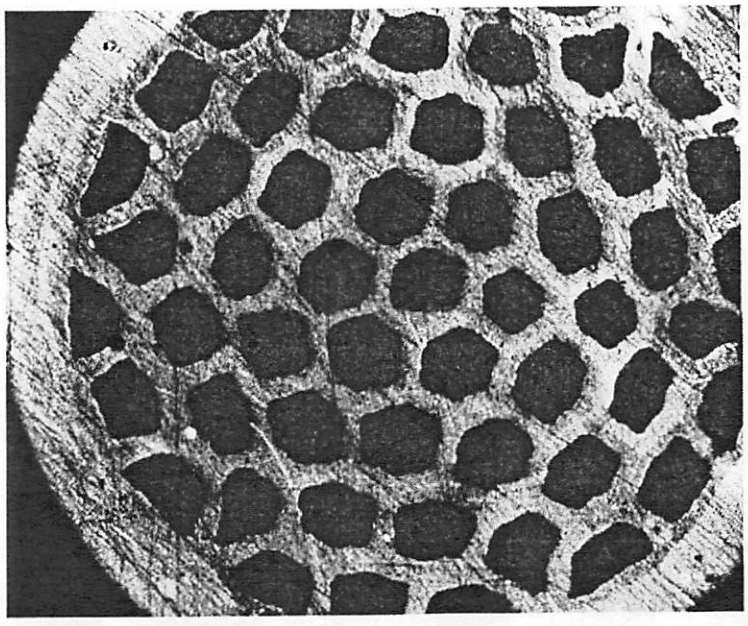


Figure 8.15. Original object image.

Images of object parts were captures with some overlapping. There are six fragments of the entire image that was acquired in series (Figure 8.16).

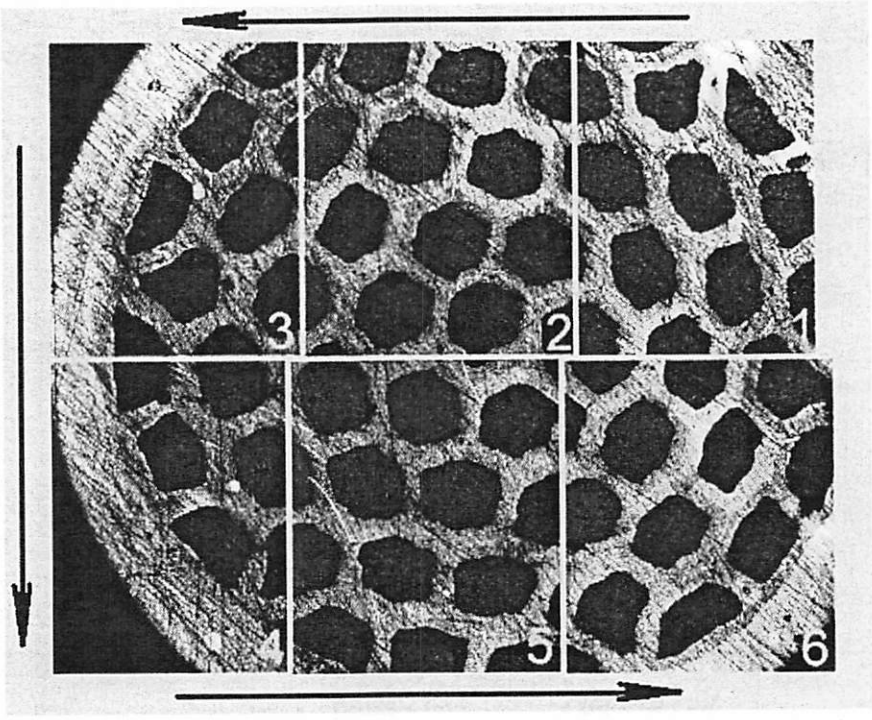


Figure 8.16. Overlapped parts of original object.

For producing the entire object image, take the following steps:

1. Make a horizontal tiling operation with images 1, 2 and 3. For this task, select these images in the Context window, in order from left to right, according to the original object parts layout (one can find how to select several images in the Context window in the Chapter 3). So, the first selected image in the Context window has to be image number 3 (see **Figure 8.17**). In this case the tiling function will unite image number 3 with image number 2, and will unite the result with image number 1. This means that the function moves from the left side of the entire object to right side, step by step. After selecting the necessary images, the **Process➢Auto tiling➢Horizontal** function may be performed. Tiling will create a new image with the result. In our example, image "Image3-Tiling result" will be generated.

2. Perform the same operations as above with images 4, 5 and 6. After this step, two horizontal parts of the original objects will be produced.

3. The last step is combining the two horizontal tiling results. Select in the Context window the first (top) and second (bottom) tiling results, one after another. Now run the vertical tiling function from the **Process➢Auto tiling➢Vertical** menu.

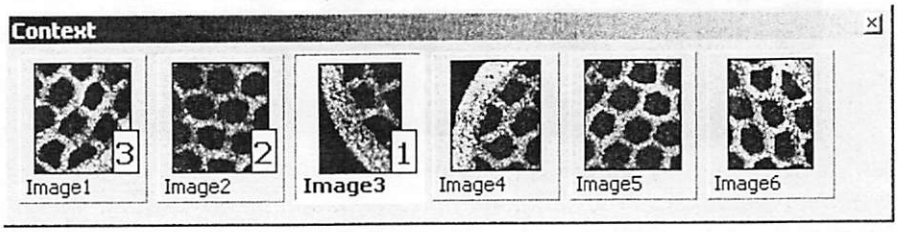


Figure 8.17. Parts for horizontal tiling operation.

Note: Tiling operations unite selected images in order from left to right (in horizontal case) and from top to bottom (in vertical case).

Tiling operations have several settings. These can be set up in the "**Tiling settings**" dialog displayed by the **Process➤Auto tiling➤Settings...** menu command. You can see an example of this dialog in **Figure 8.18.**

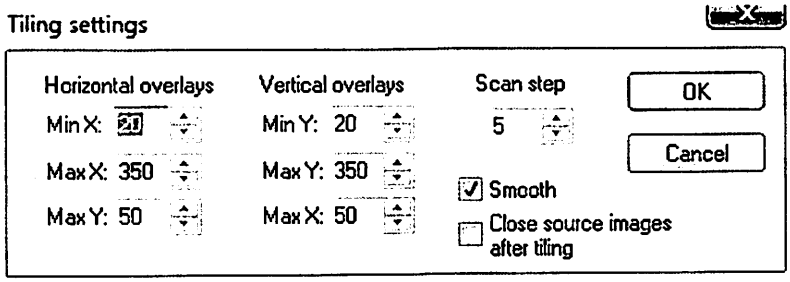


Figure 8.18. An example of "**Tiling settings**" dialog.

This figure shows the following:

- **Horizontal overlays** box contains controls that allow you to specify parameters for the horizontal automatic tiling function:
  - **Min X, Max X** fields lets you specify minimal and maximal possible overlay by X-coordinate. Scanning of adjacent images will be accomplished in these borders. Too big a range for scanning may slow the tiling process.
  - **Max Y** specifies the possible amount of vertical displacement of images.
- **Vertical overlays** box provides the same functionality as above for the vertical tiling operation.
- **Scan step** allows specifying a grid step in which similarity of adjacent overlays is estimated. A bigger size of step will speed up of processing, but precision will be decreased.
- **Smooth** flag lets you enable fluent transition from one image to another during the tiling operation. If this flag is set, the visible difference in brightness between adjacent images can be extended.
- **Close source images after tiling** flag leaves the resulting image only with closing the original images.

Note: A very big zone specified by **Min X** and **Max X** parameters can increase the processing time. On the other hand, this zone has to be enough for effective imposing of adjacent frames. **Max X** parameter has to be more than the physical overlapping between images that was obtained during image acquisition.

Max X parameter

Let's consider some aspects of choosing the **Max X** parameter. In **Figure 8.19.a** one can see two adjacent overlapped images. The blue line in this figure shows the physical edge of overlapping that from the conditions of image acquisition. Ideally we have to select a **Max X** parameter a little bit more than the physical edge (green line in **Figure 8.19.a**). But if too small a value of **Max X** parameter is selected (like red line in **Figure 8.19.a**), the tiling operation can't correctly combine images. Such a situation can be seen in **Figure 8.19.b.**

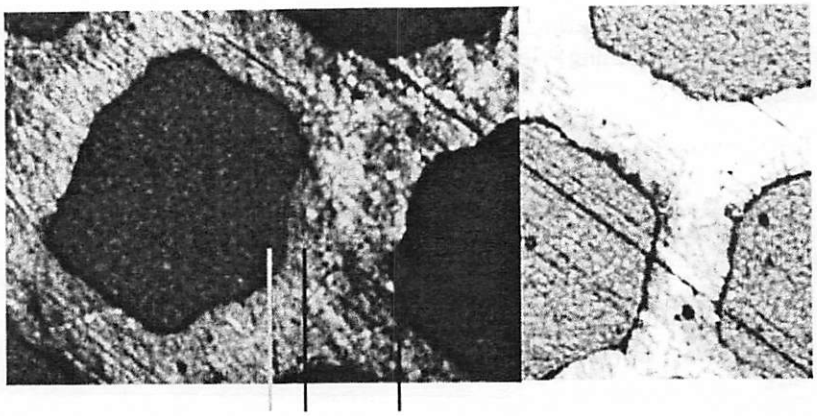


Figure 8.19.a. Choosing Max X parameter for horizontal tiling (correct Max X).

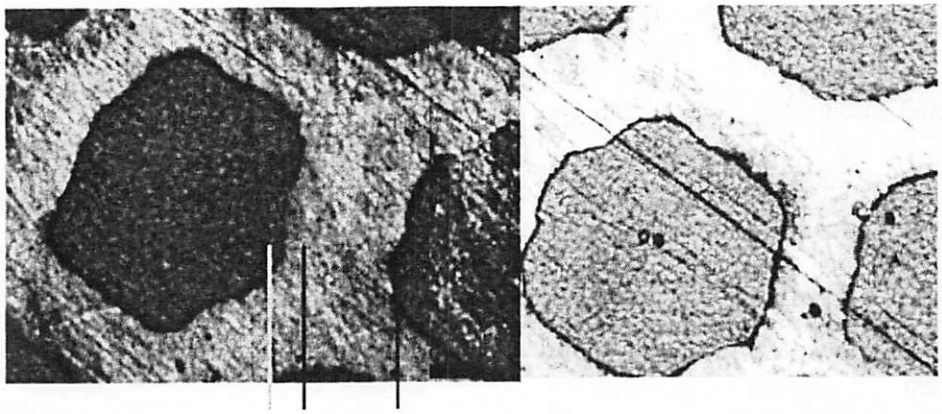


Figure 8.19.b. Choosing Max X parameter for horizontal tiling (incorrect Max X).

Smooth parameter in the settings dialog is very useful then adjacent images have several brightness values. Results when Smooth is used and when Smooth is switched off can be compared in Figure 8.20.a and Figure 8.20.b.

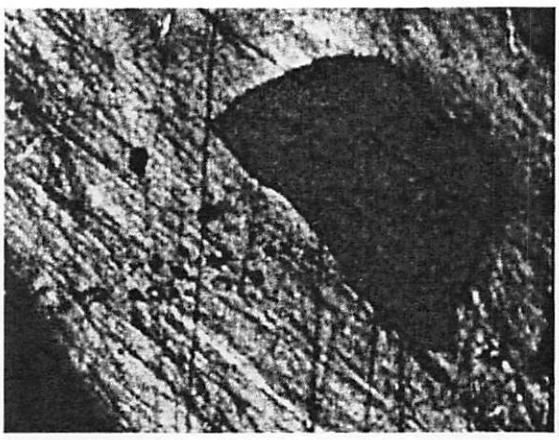


Figure 8.20.a. Smooth is on.

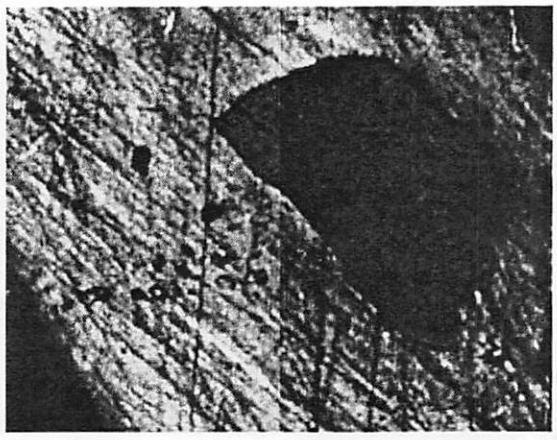


Figure 8.20.b. Smooth is off.

Manual tiling

Process➢Tiling➢Manual command lets you perform manual tiling. In this case, it is also necessary to select images for tiling beforehand in the Context Window. When the operation is on, the images for tiling will appear in the window one by one. The window for the selected images fits itself automatically to the size of the total images. You can move the images by using the arrow keys on the keyboard, or clicking the arrows in Properties➢ Manual tiling command.

Ctrl+ Arrow key makes you to move the images faster.

To match two images, move the overlay to the original image and use **Auto adjust**. When this does not work properly, you also can match the overlays of the two images manually.

Press the Enter key at the end of this operation and the next image will appear. Repeat the above steps. When the last image is done, the window terminates itself automatically and the tiled images remain.

Smoothed combining in the dialog box below eliminates the differences in brightness between images to make a natural-looking combination of the images. At first, select the images in the window by clicking the mouse button while holding the Ctrl key. **Horz** operates the horizontal treatment of images and **Vert** does vertical treatment.

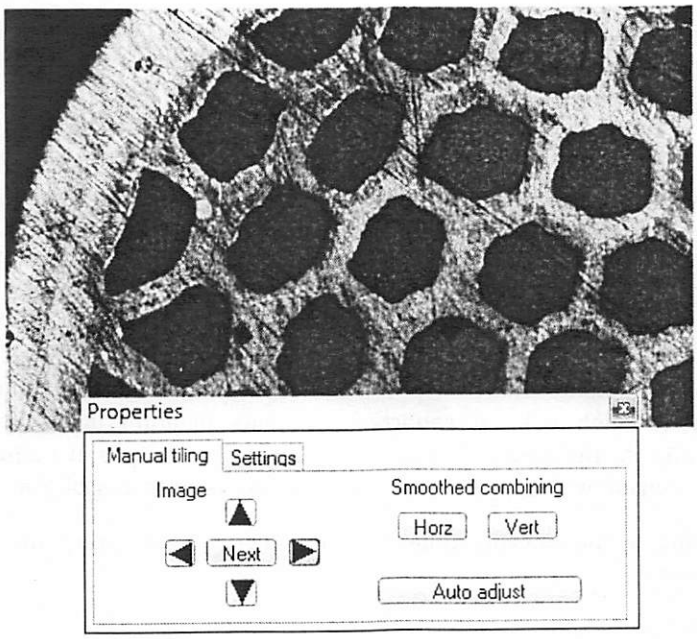


Figure 8.21. An example of **"Manual Tiling Properties"** dialog box

On the **Settings** tab the **Overlay** option selects an overlay image type. **Add** shows transparent overlay images. **Sut** displays inverted images. **Transparency** sets the degree of transparency of overlay images.

Background button allows you to select the background color for the tiled images.

Close source images after tiling closes the original images with only tiled images remaining.

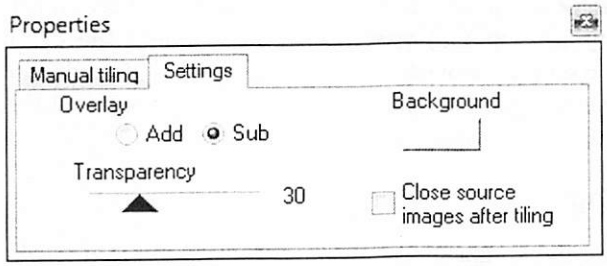


Figure 8.22. An example of **"Manual tiling Settings"** dialog box.

Chapter 9 - Measuring and Counting

This chapter describes how to measure image objects, view data, and work with the measured data. The main task of the program is to take measurements upon your images. The program lets you perform spatial measurements manually or automatically. You can perform measurements in two ways:

- **Manually measuring single objects.** The program gives you a lot of tools that can define features such as lines, polylines, polygons, and arcs, and measure their characteristics. You can also measure distances between any two features. For example, you can measure the length of lines that you define, the area of polygons that you define, and the angles of arcs that you define.

Measurement operations are performed in terms of image pixel positions, e.g., the length of a measurement is determined by the number of pixels along the line, the area of an outlined object is determined by the number of pixels within the outline, and so forth.

Note: When the program performs a measurement, the pixels included in the outline are included in the measurement. For example, when you are measuring the area of the object you have outlined, the pixels making up the outline are included in the area calculation. When an outline crosses over the pixel, the program calculates it as a half of the pixel. This makes the measurement error from one pixel to a half a pixel.

Your pixel-level measurements can be scaled to fit any coordinate system that allows you to obtain measurements, which will be reported in terms meaningful to your application. For example, you can calibrate the measurement scale so that five pixels are equal to one micron (or inch, or mile). The program will express your measurements in terms of that unit.

If your image contains a measurable object with known length, you can calibrate your scale directly using that object.

Calibration

Calibration is necessary to obtain actual measurements. This program expresses the measurements such as length and area of objects by the pixel location and number. Calibration is a process that defines how many pixels in images are scaled as micrometers, inches, miles, and nanos. For optical microscopes, 1/100 mm scales are usually used. For electronic microscopes, you can calibrate the images by scale bars on the images.

Use the **Measure➤Calibration➤** command to work with spatial calibration. It is used to create a new spatial scale, to modify the existing spatial scales, to select the calibration for measuring your image, and to draw a calibration marker in your image. By default, the program expresses spatial measurements in terms of pixels, but you can use this command if you want to measure objects in terms of microns, inches, nanos, or miles.

Spatial Calibration dialog

When you select the **Measure➤ Calibration...** command, the **"Spatial Calibration"** dialog box is displayed. You can find an example of this dialog box in **Figure 9.1**.

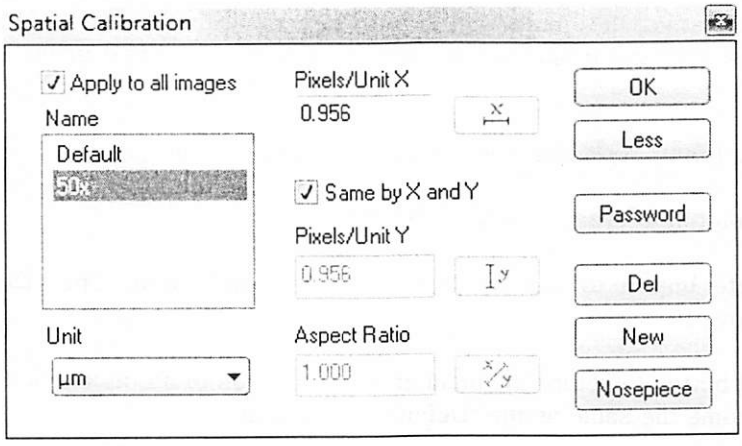


Figure 9.1. The "**Spatial Calibration**" dialog box.

This dialog contains the existing calibration. You can apply any of them to the image. This dialog box allows you to create a new calibration. You can also modify the name, unit name, pixels-per-unit and aspect ratio values of the desired calibration. The calibration with the "**Default**" name is the default program calibration, and cannot be modified.

Figure 9.1. shows the following:

- The **Name** list box contains the names of the existing calibrations. You can select the calibration you want to apply to the image by highlighting its name in this control. If you want to use the program default calibration, select "**Default**". If the "**Default**" calibration is the only listed one, you can create a new one by clicking the **New** button and specifying its values.

- The **Unit** combo box contains all available unit names. You can choose the desired one for the selected calibration. You can also type the name of your unit in this field.

- The **Pixels/Unit X** field contains the pixels-per-unit value that displays the number of pixels that represent a single unit in both the horizontal and vertical directions. You may either enter the desired value directly into this field by typing the value, or you can click the button to specify the values from an object of the known length in your image. Usually users click 1/100mm scale with the button to obtain the pixels-per-unit value.

- The **Same by X and Y** flag allows you to specify that the calibration has different pixel-per-unit values in horizontal and vertical directions.

- The **Pixels/Unit Y** field contains the pixels-per-unit value that displays the number of pixels that represent a single unit in the vertical direction when the pixels-per-unit value in the vertical direction differs from the same one in the horizontal direction. You may either enter the desired value directly into this field by typing the value, or you can click the button to specify the values from an object of the known length in your image.

- The **Aspect Ratio** field contains the value that represents the relationship between the horizontal and vertical axes in your image. This value is the ratio of the pixels-per-unit value in the horizontal direction to the pixels-per-unit value in the vertical direction. It is used to compensate for distortion on an image acquired with a camera having an aspect ratio different from that of the displaying device. You may either enter the value directly into the **Aspect Ratio** field by typing the value, or you can click the button to specify the value from an object that is known to be square in your image. You may also indirectly specify the

Aspect Ratio by setting the Pixels/Unit Y value to a value that is not equal to the Pixels/Unit X value. In this case the program will automatically calculate and update the Aspect Ratio value.

- Click the OK button to apply the selected calibration to your image.
- Click the New button to create a new calibration.
- Click the Delete button to remove the highlighted calibration. The "Default" calibration cannot be removed.
- Click the Reset button to return the highlighted calibration to its initial state, which means its values will become the same as the "Default" calibration.

Tip: In order not to modify or delete the calibration value by mistake after completing the process, click the Less button to minimize the window that only contains names of calibration ratios. You can return it to its original size by clicking the More button below OK (this will be changed into Less, and vice versa).

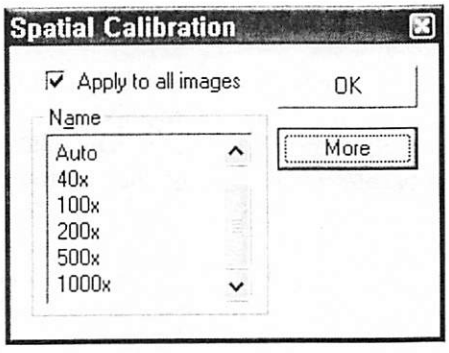


Figure 9.2. An example of the "Less" window.

To apply the desired calibration to the image, you need to highlight its name in the Name list box and click the OK button.

Modify existing calibration

The "Spatial Calibration" dialog box allows you to modify any of the existing calibrations excluding "Default".

Note: You will not be able to modify the "Default" calibration.

Proceed as follows:

1. If you want to change the name, unit name, pixel-per-units and aspect ratio values of the desired calibration you need to highlight its name in the Name list box first.
2. You can change the name of calibration by double-clicking on it in the Name list box and typing a new name in the in-place edit box over the previous one.
3. You may change the unit name by choosing the appropriate name in the Unit combo box. You can also type the name of your unit in this field.
4. Now you may either enter the pixels-per-unit value directly into the Pixels/Unit X field

by typing the value, or you can click the button to specify the values from an object of the known length in your image. When you select this button, the "Properties" tab window containing the "Units" tab will be displayed, and a defining line will be placed in your image. Figure 9.3. shows an example of the "Units" tab.

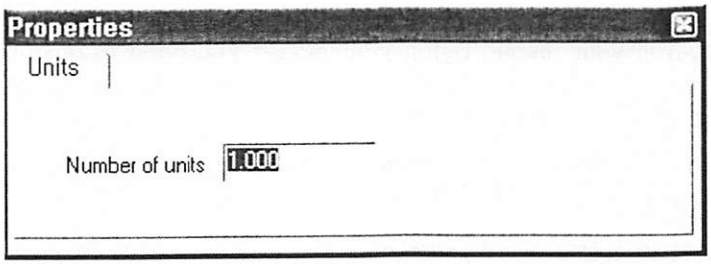


Figure 9.3. An example of the "Units" tab.

5. In the Number of units field of this window you need to specify the number of units your reference object represents. Then, using your mouse you must place the defining line over the length of the object to specify its size in pixels: position and then stretch the defining line so that its length is equal to the length of the reference object. Then click button to complete the measurement. The program will calculate the calibration by dividing the number of pixels under the defining line by the unit number you have specified in the "Units" tab. The result will be placed in both the Pixels/Unit X and Pixels/Unit Y fields.

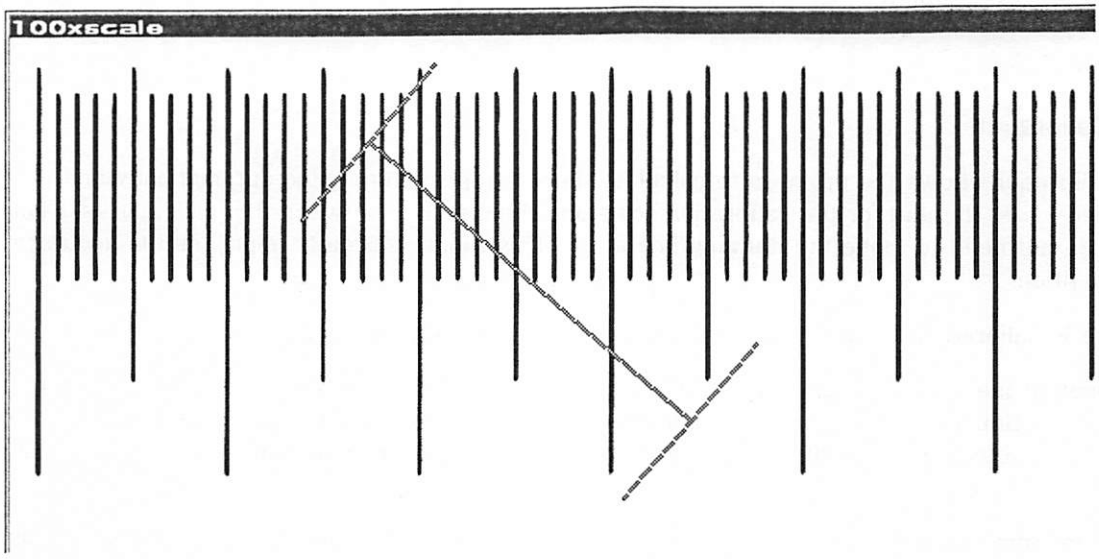


Figure 9.4. An example of the "defining line".

6. If you want the calibration to have a different pixels-per-unit value in the horizontal and vertical directions, you must clear the Same by X and Y flag. Then the Pixels/Unit Y and Aspect Ratio fields will be enabled; otherwise these fields will be disabled.

7. If Same by X and Y is not set you need to specify the Pixels/Unit Y value. There are two ways to do it:

   - You can either enter the desired value directly into the Pixels/Unit Y field by typing the value, or you can click the button to specify the values from an object of the known height in your image. The procedure of defining of the Pixels/Unit Y value is the same for defining the Pixels/Unit X value. After the Pixels/Unit Y value is calculated, the result will be placed in the Pixels/Unit Y fields. If the Pixels/Unit Y value is not

equal to the **Pixels/Unit X** value, the program will automatically calculate and update the **Aspect Ratio** value.

- You may either enter the **Aspect Ratio** value directly into the **Aspect Ratio** field by typing the value, or you can click the x/y button to specify this value from an object that is known to be square in your image. When you select this button, a *defining line* will be placed in your image. Using your mouse you need to position the defining line diagonally over your square object and stretch the defining line so that its length is equal to the diagonal length of the square object, from corner-to-corner. Then click the x/y button to complete the measurement. The program will calculate the **Aspect Ratio** and update the **Pixels/Unit Y** value if it is necessary.

8. After your calibration is defined you can apply it to your image by clicking the **OK** button.
9. The program will store the new calibration automatically when you close the "**Spatial Calibration**" dialog box.

Creating a new calibration

You can create a new calibration by clicking the **New** button in the "**Spatial Calibration**" dialog box and entering your calibration values in the appropriate fields. When a new calibration is created, the program places its name in the **Name** list box and activates the calibration fields. By default, the program assigns the name "**Spatial0**" to a new calibration; however, you may change it to something more descriptive. You may want to modify the unit name, pixel-per-units, and aspect ratio values of the just created calibration. You can do it the same way as described above. The program will store the new calibration automatically when you close the "**Spatial Calibration**" dialog box.

Auto Calibration

Auto Calibration allows the program to calculate the pixel-per-units value automatically and you only need to set the unit for the calibration scale and the distance between the scale marks. That is, you do not need to move the defining line at all. This function greatly improves the accuracy and repetition.

Measure ➢ **Calibration** ➢ **Auto** command shows the dialog box below.

Magnification means the magnification of the microscope. This only provides a name, not the actual calibration value. The magnification offers a drop-down style, and you also can type the name of magnification manually. In this case, you can delete what you want by clicking the **Del** button in the dialog box.

Unit of micrometer object sets the actual distance between the scale marks in the scale for calibration. The example below set the scale with a 10-um distance.

OK button will perform the Auto calibration.

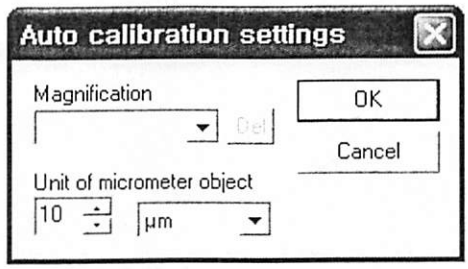


Figure 9.5. An Example of the "Auto" dialog box.

Semi-auto Calibration

Semi-auto calibration needs a mouse drag, but does not need the defining lines. Instead, the program automatically perceives the marks on the scale. In other words, the program automatically perceives the mark when you drag your mouse on the scale image. This function is useful when you need to use a non-ordinary calibration scale.

Measure ➤ Calibration ➤ Semi-auto command will show you the same dialog box as **Auto Settings.** You can set the setting in the same way you did in **Auto Settings.** After that, click OK and you will see another dialog box as illustrated in **Figure 9.6.** below. The figure shows the following functions:

- **Detector** sets the position the scale detects. This is to eliminate the errors that can occur in calibration because every scale mark has a line width of its own. Detector options are:
  - **Dark to bright point** automatically detects edges when it moves from the dark point of the scale to the bright point.
  - **Bright to dark point**, in reverse, automatically detects edges when it moves from the bright point of the scale to the dark point.
  - **Dark center** automatically detects the mid point of each scale when the scale mark is white on a black background.
  - **Bright center** automatically detects the mid point of each scale when the scale mark is black on the background.
- **Edge threshold** option sets the degree of differences in brightness of edge lines. Edge threshold has degrees from 1 to 10. A low threshold figure means less contrasts on edges, while a high figure means more contrast. Some extreme settings such as 1 and 10 often terminate the auto-detecting function.
- **Smooth** makes the edges smooth so that the program perceives them as straight lines.

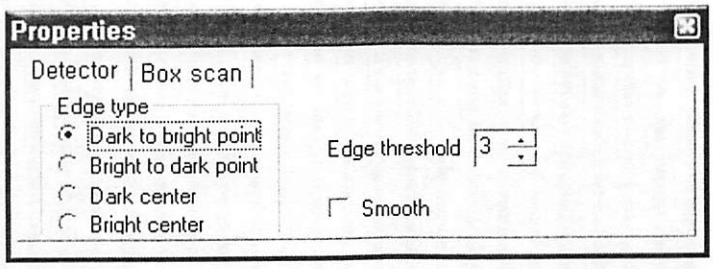


Figure 9.6. An example of the "Semi-auto" dialog box

The **Box scan** window is shown in **Figure 9.7** It sets the number of marks and the line width of the marks when the program detects the marks on the scale, as follows:

- In **Scan lines distribution:**
  - **By number** option defines the number of marks detected when you drag mouse following the straight scale. The example below shows 10 detector marks.
  - **By pixels** option sets the distances between detector markers by pixels. The example below will show the detector markers on every 5 pixels.

- **Area half width** sets the width of the detector box when you drag your mouse following the scale. This figure represents the number of pixels, from a minimum of 5 to a maximum of 300.

- **Show edge points** option selects whether the program shows edge point or not.

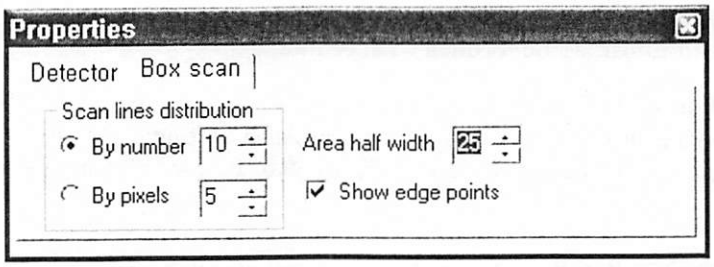


Figure 9.7. An Example of the **"Box scan"** dialog box

If you made a new setting or decided to use an existing setting, make a **vertical** drag with your mouse from the starting point on the scale on the image. The detector marks will appear on the scale. Next, make a **horizontal** drag with your mouse and make sure that you start a bit apart from the starting point of the vertical drag. Otherwise, you will move the position of the first scale box instead, making a horizontal detector box.

After all operations you will see the box and detector marks as illustrated below. The program already calculated the calibration value.

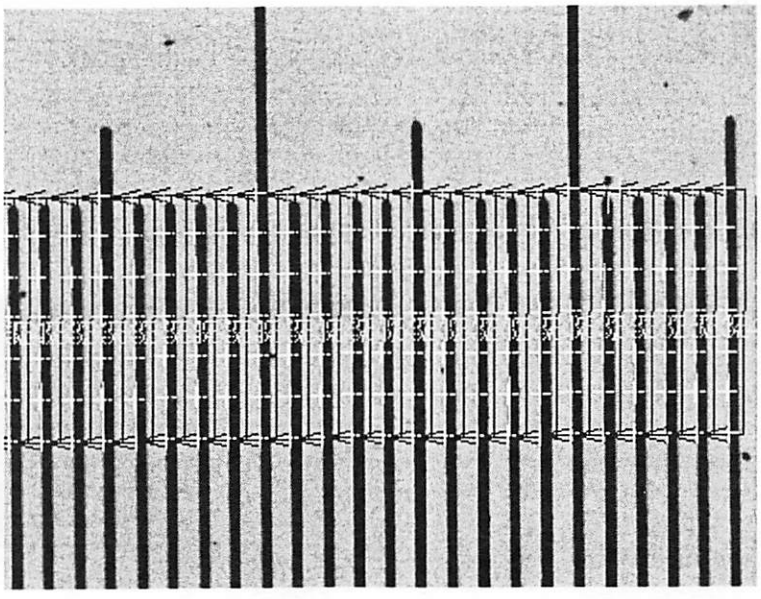


Figure 9.8. A Result of **Semi-auto Calibration**

Save and load calibration

Calibration settings can be saved and loaded using special text files with **clb** extension. Command **Measure➢Calibration➢Save active...** is used to save the current selected calibration in its own file. This command is active only when active calibration is not the **Default**.

Command **Measure➢Calibration➢Save all...** is used to save all calibration currently represented in the program. All calibrations are stored in one common file. This command is active only when at least one calibration, except **Default**, is available in the program.

To open an existing file with calibration(s) use the **Measure➢Calibration➢Open** command. It is necessary to restart the "**Spatial Calibration**" dialog (if it was currently opened, of course) for changes.

If you want to re-install the program and use the calibration, you do not need to perform a new calibrations and just use **Measure ➢ Calibration) ➢ Open** command and open *.clb file.
Take note that the program does NOT open *.clb calibration file with **File ➢ Open** command.

Password option does not allow changing the existent calibration if one does not know the password.

Tip: You can easily select the saved calibrations with the dropdown menu that appears by pressing the arrow on the right side of the toolbar button.

Marker

To place a calibration marker on the image, click the (**Marker**) button in the "**Spatial Calibration**" dialog, and the **Create Marker** command will start. It will place a new marker in the center of your image window. You can drag the marker to the desired position on your image using the mouse. The **Measure➢Calibration➢Create Marker** command displays the "**Properties**" tab window, which contains three tabs: "**Units**", "**Color**" and "**Settings**".

The "**Units**" tab allows you to specify the marker length in calibration units. You can find an example of this tab in **Figure 9.9**.

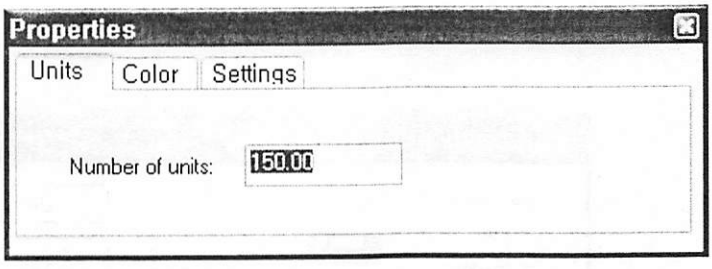


Figure 9.9. An example of the "**Units**" tab.

The "**Color**" tab allows you to specify the Background and Foreground colors. You can find an example of this tab in **Figure 9.11**.

As you can see, the "**Color**" tab for the calibration marker is the same as for annotation objects. You can specify the desired Background and Foreground colors for a marker the same way as for annotations.

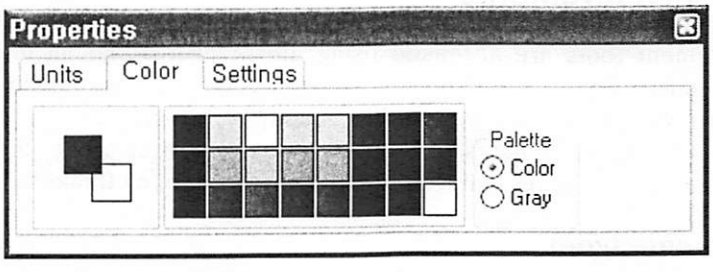


Figure 9.10. An example of the "**Color**" tab.

You can find an example of the "**Settings**" tab in **Figure 9.11**. This tab lets you specify the font and its attributes. The chosen font will be used to draw the marker. This tab contains the **Transparent** flag, which lets the image be shown through a drawing on it. If this flag is not set, the marker is enclosed in a box filled by the Background color. **Thickness** sets the thickness of

the font. Unchecking the **Show text** flag gets the calibration marker without text.

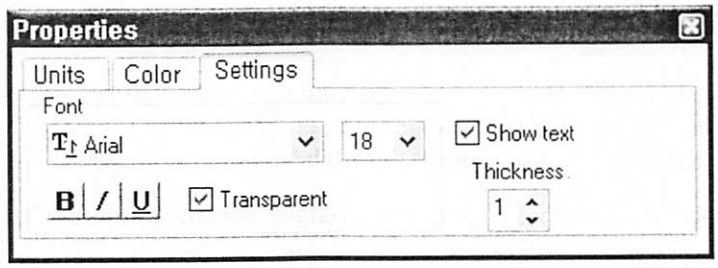


Figure 9.11. An example of the "Settings" tab.

Clicking the right mouse button or double-clicking the left mouse button will burn the marker to your image, and it will be a permanent part of your image. After that the **Create Marker** command will be completed. You can also do the same by clicking the (**Marker**) button in the "**Spatial Calibration**" dialog box one more time.

Split marker

This function divides images into 4 or 16 parts according to the units and value of calibration.

The **Measure** ➢ **Calibration** ➢ **Split marker** command displays the **Split calibrations marker** dialog box. The **Split number** option splits the image into 4 or 16. The **Color** option sets the color of splitting lines. The **Font** option concerns the font size in the horizontal and vertical length of the splitting lines and the total area of the images.

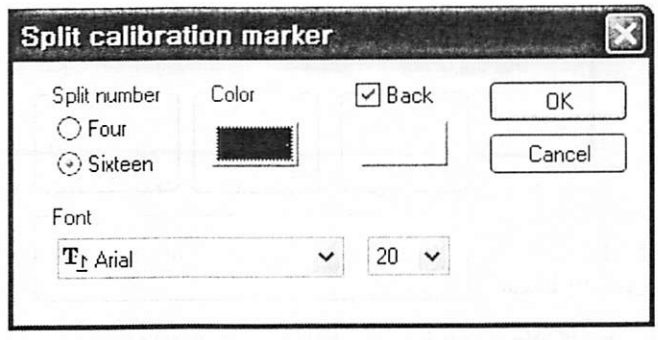


Figure 9.12. An example of the "Split calibration marker" dialog box.

Taking Manual Measurements

The manual measurement tools are accessed using the **Measure**➢**Manual measurements** popup menu items. The manual measurement tools are useful for obtaining individual measurements, and they are the only way to obtain straight-line length and thickness measurements. You can define features that have measurements of their own (the length of a line, for example) or take measurements between two existing features (i.e. distance, angle, or thickness).

Manual Measurements types

Here are all the measurement types that you can take from the measurement features:

- **Center Point X** represents the X-coordinate of the feature central point.
- **Center Point Y** represents the Y-coordinate of the feature central point.

- **Area** represents the feature area.
- **Length** represents the feature length.
- **Radius** represents the circle feature radius.
- **Diameter** represents the circle feature diameter.
- **Start Point X** represents the X-coordinate of the feature initial point.
- **Start Point Y** represents the Y-coordinate of the feature initial point.
- **End Point X** represents the X-coordinate of the feature end point.
- **End Point Y** represents the Y-coordinate of the feature end point.
- **Angle** represents the angular measurement:
  - for an individual line feature it is angle between the line feature and X-axis.
  - for two lines features it is angle between these lines features.
- **Min Distance** represents the minimal distance between two feature.
- **Max Distance** represents the maximal distance between two features.
- **Ctrl-to-Ctrl Distance** represents the distance between the central points of two features.
- **Perpendicular Distance** represents the distance between parallel lines.

The following table contains most types of measurement features provided by the program.

	Measurement types													
Feature	Center Point		Area	Length	Radius	Start Point		End Point		Angle	Distance			
	X	Y				X	Y	X	Y		Min	Max	Ctrl-to-Ctrl	
Point	✓	✓												
Line	✓	✓		✓		✓	✓	✓	✓	✓				
Spline	✓	✓		✓		✓	✓	✓	✓					
Polyline	✓	✓		✓		✓	✓	✓	✓					
Polygon	✓	✓	✓	✓										
Circle	✓	✓	✓	✓	✓									
Rectangle	✓	✓	✓	✓										
Angle	✓	✓				✓	✓	✓	✓	✓				
Distance											✓	✓		✓

To obtain manual measurements you should take some basic steps.

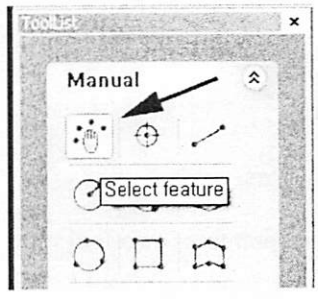
1. Select the measurement tool you need to obtain your measurement by choosing the appropriate item in the **Measure➤Manual Measurements** popup menu, or by pressing the tool button (point, line, circle, etc.) in the "**Manual**" toolbar.

2. Take the measurement in your image. Each command has its own way of obtaining a measurement: you need to select two existing straight lines to measure the angle between them, stretch a defining line to get a straight-line length, or outline an object to obtain an area. You will find the details about technique below in command description.

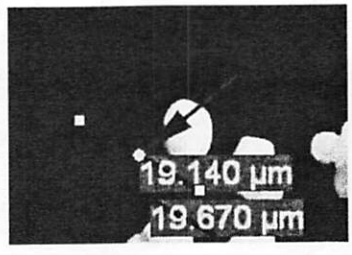
3. When you take a measurement, the measurement object is highlighted and numbered in the image, and measurement values are placed in this object. You can see results in Measurement View. You may take as many measurements as you need. The values of each will be recorded and can be stored to file later. You need to have both Image View and Measurement View in your window simultaneously to show results during measure.

The following commands are used to take the manual measurements:

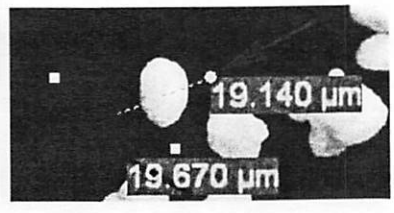
- **Select feature**: This button is used to select and modify existing measurements and/or features.



1



2



3

Once you have completed a manual measurement, choose "Select Feature" in the Manual Measurement toolbox. Next click the target object. When you see the color dot on the center of the line, drag the dot to a new position. You can place the measurement value label anywhere on the image. For some objects (circle, polygon, spline) this feature is switched off as they have label in their center.

- **Point**: This button is used to create a point feature on the current image. Click the left mouse button on an image to create the Point feature you need. While drawing an object and holding the left mouse button down, you can move the created object along the image. According to the settings during and after creation of the object, you can see near the object its name or the measurements, i.e. center point coordinates. After you have drawn the object and selected it with the **Select feature** command, you can move it along the image. During this operation the object measurement values can change.

- **Straight Line**: This button helps to create a straight-line feature on the current image. To create a straight-line feature, click the left mouse button in the start point of the line, then hold the left mouse button down and draw a line. Release the left mouse button at the end point of the line. According to the settings during and after creation of the object, you can see near the object its name or the measurement value, i.e. the length.

- **Circle by radius (Circle feature)**: Use this button to create a circle feature on the current image. To draw the figure press the left mouse button – it is the center point of the circle – and holding it down, move the cursor to the desired position to create the circle of the needed radius. Then release the mouse button – it is the point of the circle. According to the settings during and after creation of the object, you can see its name or the measurement value, i.e. the radius.

- **Best-fit circle by N points feature:** Use this button to create a circle feature on the current image. Press the left mouse button on several points of the image and press the right mouse button and you will have a circle that connects all the points you have selected. According to the settings during and after creation of the object, you can see near the object its name or the measurement value, i.e. the radius.

- **Circle by diameter (Circle feature):** Use this button to create a circle feature on the current image. To draw the figure press the left mouse button – it is the center point of the circle – and holding it down, move the cursor to the desired position to create the circle of the needed diameter. The distance from a starting point to an ending point is the diameter of the circle.

- **Circle by 3 point:** Select this button to create a circle feature on the current image. This circle is based on 3 points that lay on the circle edge. To create the figure, click three times with the left mouse button to draw the first, second and third points. With the help of these three points, a circle will be created by a least-square approximation method. According to the settings during and after creation of the object, you can see near the object its name or the measurement value, i.e. the diameter.

- **Rectangle:** This command allows you to create a rectangular measurement feature. To draw this figure press the left mouse button – it is the left top corner point of the rectangle – and holding it down, move the cursor to the desired position to create the point of the right bottom corner of the rectangle. According to the settings during and after creation of the object, you can see near the object its name or the measurement value, i.e. the area.

- **Polygon:** Select this button to create a polygon feature on the current image. This will always yield a closed figure. Polygon includes straight line segments and (or) smooth edges. The vertexes are set by the left mouse button clicks. To create a polygon, simply click the left mouse button at each vertex (including the beginning point) of the polygon. Smooth edges are created by holding the left mouse button down while you draw with the cursor. Click the right mouse button closes the polygon. According to the settings during and after creation of the object, you can see near the object its name or the measurement value, i.e. the area.

- **Polyline:** This button is used to create a polyline feature on the current image. This will always yield an open figure. Polyline is a figure that includes straight line segments and (or) smooth edges. The vertexes are set by the left mouse button clicks. To create a polyline, simply click the left mouse button at each vertex (including the beginning point) of the polyline. Smooth edges are created by holding the left mouse button down while you draw with the cursor. Click the right mouse button closes the polyline. According to the settings during and after creation of the object, you can see near the object its name or the measurement value, i.e. the length.

- **Spline:** This button is used to create a spline feature on the current image. This will always yield an open figure. Spline is a figure created by a bicubic spline function on the given points. The points are set by clicks of the mouse. To create a spline, simply click the left mouse button at each point, including the beginning one. The spline edges will be drawn automatically during spline creation. Click the right mouse button to closes the spline. While drawing a spline, point and hold the left mouse button down to move the created point along the image. According to the settings during and after creation of the object, you can see near the object its name or the measurement value, i.e. the length.

- **Lines from reference point:** With this command it is possible to create a set of lines with a common reference point. The reference point is selected by first making left mouse click. A special dotted preview line will appear to show the line that will be. You can create as many

lines as you need just by one mouse click. According to the settings during and after creation of the object, you can see near the object its name or the measurement value, i.e. the length.

- **Auto trace**: This command is similar to **Polygon**, but it has one additional feature – automatic edge finding, initiated by double-clicking the left mouse button. The **Auto trace** command displays the "**Properties**" tab window (see **Figure 9.13**).

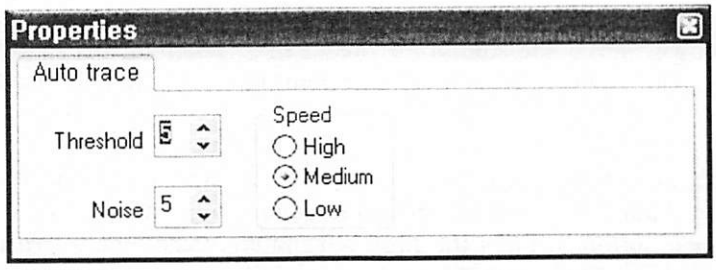


Figure 9.13. An example of "**Properties**" for the **Auto trace** command.

This dialog lets you specify several attributes:

- **Threshold** for edge finding takes a value from 1 to 10. Smaller threshold value corresponds to low-contrast edge and vice versa; bigger threshold values correspond to high contrast edges.
- The **Noise** parameter takes values from 0 to 5 and determines the power needed for edge smoothing. Zero noise means that the program will not smooth an edge at all. Bigger values will result in smoother trace lines (some nooks and crannies may be omitted), but it may helps to find edges on noisy images.
- **Speed** parameter controls the visual speed with which trace-finding is performed. Speed does not influence the quality of the auto trace function.

Before making a mouse double-click for automatic edge finding it is necessary to define two points along the edge you want to trace. Trace finding will be stopped if the first point of the polygon is reached, or if an edge was lost, or if the left mouse button or [SPACE] key was pressed. While auto trace is stopped, it is possible to remove the last trace points by using the [BACKSPACE] key. Trace finding may be started again by double clicking (last two points will be used to determine the initial edge direction, so you can specify them). To complete this function (in this case polygon will be closed) right mouse button have to be pressed. Right mouse button also terminates current auto trace finding process if any.

- **Lines with common reference point**: Use this button to create a group of lines with a common reference point. First press the left mouse button to set a common reference point. Then another left mouse-button click displays preview dotted lines representing the lines to be made. You can make as many as you want by just pressing the left mouse button. Pressing the right mouse button finishes the process and shows you a straight length of each line.

- **Angle**: Use this button to create two new lines and take an angle measurement between these two lines. The lines do not need to intersect. The angle is measured from the first line to the second one, in a counter-clockwise direction. Note that this tool is different from the other measurement tools because you create two features first and then the measurement is taken. According to the settings during and after creation of the object, you can see near the object its name or the measurement value, i.e. the angle.

- **Parallel lines**: With the help of this command you can create a reference straight-line feature, with several straight lines that are parallel to the first one. Just create the first line by the same manner as for the line feature mentioned above, then specify locations of parallel lines

by left mouse clicks. For your convenience, a preview dotted line appears after creation of the first reference line. This preview line shows the position of the current parallel line that will be created following a left click. The perpendicular distance measurements are taken between adjacent parallel lines.

- **Perpendicular width measurements**: With the help of this command you will create the reference straight line feature and several dots. The perpendicular distance measurements are taken the reference line and the dots. Create the reference line first, and press the left mouse button to make the dots. You can press the left mouse button as many times as you want to make dots. The perpendicular distance measurements are taken the reference line and all the dots.

- **Angle between 2 lines**: This button creates a measurement of the angle between two existing line features. The angle is measured from the first line drawn to the second one, in a clockwise direction. After you have chosen this measurement tool, select two lines. If two lines are already selected, the measurement will be added immediately; otherwise the measurement is added when the second of two lines is selected. The selection is then cleared, and you can continue to select lines and add more measurements. According to the settings during and after creation of the object, you can see near the object its name or the measurement value, i.e. the angle.

- **Distance**: Use this button to create a measurement of the distance between two features. First of all select two objects on the image. If two features (objects) are already selected, the measurement will be added immediately; otherwise the measurement is added when the second of two features is selected. The selection is then cleared, and you can continue to select features and add more measurements. According to the settings during and after creation of the object, you can see near the object its name or the measurement value, i.e. distance.

- **Perpendicular distance**: Use this button to create a measurement of the perpendicular distance between two features. First of all select two objects on the image. If two features (objects) are already selected, the measurement will be added immediately; otherwise the measurement is added when the second of two features is selected. The selection is then cleared, and you can continue to select features and add more measurements. This command takes a measurement of the perpendicular distance based on the first object.

Visualizing measurements data

Measurement View

Select the **View ➤ View type ➤ Manual** command or click [tab] tab from the left under of the window. **Measurement View** includes every possible measurement for all the features and measurements that you have created for the active image of the document window. This view displays its contents in a data sheet form.

You can find an example of Measurement View in **Figure 9.14.**

Number	Name	Area, µm*µm	Length, µm	Radius, µm	Diameter, µm	Angle	Perp. Distance, µm
1	L1		125.994			233.530	
2	L2		121.485			225.000	
3	L3		99.118			233.130	
4	CR1	13732.922	415.419	66.115	132.231		
5	BCR1	10852.209	369.286	58.773	117.547		
6	CD1	5151.751	254.438	40.495	80.990		
7	R1	12866.541	453.744				
8	SP1		247.168				
9	A1					66.779	
10	L4		345.892			223.451	
11	L5		345.892			43.451	
12	PF1						121.525
13	L6		345.892			43.451	
14	PF2						84.162
15	L7		345.892			43.451	
16	PF3						133.981

Figure 9.14. An example of Measurement View.

The first column, "Number," contains the numbers assigned to each feature. The second column, "Name," contains features names. The rest of the columns contain measurement values, and their headers show measurement names.

Each row represents feature properties and measurement values. You can edit the name of a feature by clicking on the name in that feature's grid row and typing a new name.

Rows and columns can be resized. To change the column width you need to place the mouse pointer at the right edge of the desired column header, press the left mouse button, hold it down, and drag the pointer in the desired direction. After you release the left mouse button the column will be resized. Double click on the right edge of the column header to set the most appropriate width of the column. The same technique can be used to change the row height, but in this case you need to place the mouse pointer on the bottom edge of the desired row at the first column.

Measurement View supports single row selection. The selected row is highlighted by the dark color. When you have one or more selected objects on the image or this view, you can delete the feature of all of its related measurements by pressing the [DELETE] key on the keyboard, or choosing the **Edit➤Delete** menu.

Measurement View contents are dynamic, i.e. the data sheet will change as you add, remove or modify features.

Manual tagging and counting

The manual tagging tool is accessed using the **Measure➤Manual tag** command. The manual tagging tool is used to mark objects in the image within one class, or in different classes, by mouse clicking. Each class of the objects has own color and symbol, i.e. tag. Command **Measure➤Manual tag** has a "**Properties**" tab window like in **Figure 9.15**.

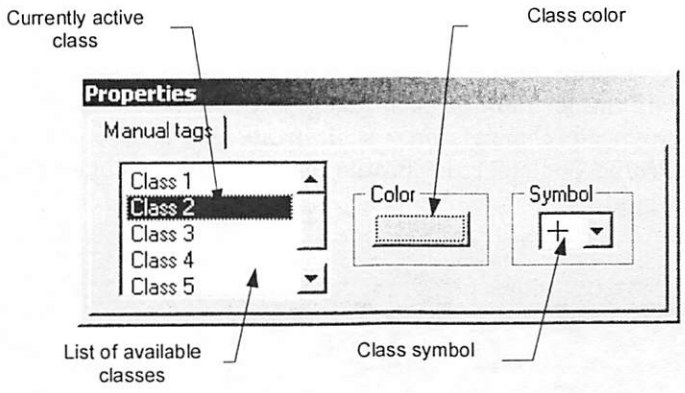


Figure 9.15. An example of "Properties" dialog of the Measure➢Manual tag command.

At any time you can change the class name, color, and symbol.

If there is a currently active class in the class list, then by each left mouse click one new tag of this class will be created. If there is no currently active class, then a new class with its own color and symbol will be generated automatically. If you right-click on the Image View, the active class will be reset, and a left mouse click will now generate tags of a newly created class. So, you can create all tags of one class with the left mouse button, then simply switch to another class by using the right mouse button, then continue the manual tagging process. One can also reset the current active class by clicking at the bottom point of the class list field. At any time you can select an existing class in the class list and add several objects of this class.

The process of creating tags may be finished by switching off the Measure➢Manual tag command, or simply by pressing the [ESC] key. Later you may continue manual tagging with created classes.

Tip: You can delete all manual tags by Edit➢Delete all... command.

Visualizing manual tags data

Manual tags View

Manual tags View includes information about classes of tags generated by the Measure➢Manual tag command. You can find an example of Manual tags View in Figure 9.16.

Symbol	Class name	Count	Grand total	% Count	Count per 1 µm*µm
○	Class 1	4	41	9.756	0.000
+	Class 2	3	41	7.317	0.000
×	Class 3	11	41	26.829	0.000
□	Class 4	9	41	21.951	0.000
	Class 5	14	41	34.146	0.000

Figure 9.16. An example of Manual tags View.

For each class the following information is shown: class symbol, class name, number of tags in this class, total number of created tags, and percent of class tags out of the total number of tags.

Class name can be edited by mouse left button double click.

Profile

This command displays a graph of the intensity value of each pixel for any line drawn across the image. The X axis gives the location of each pixel. The Y axis shows the intensity value of the red, green, blue, or grayscale channels on a scale from zero to 255. To view the graph, select View > View type > Profile or select the Profile button in the document window to display the Profile View pane or window.

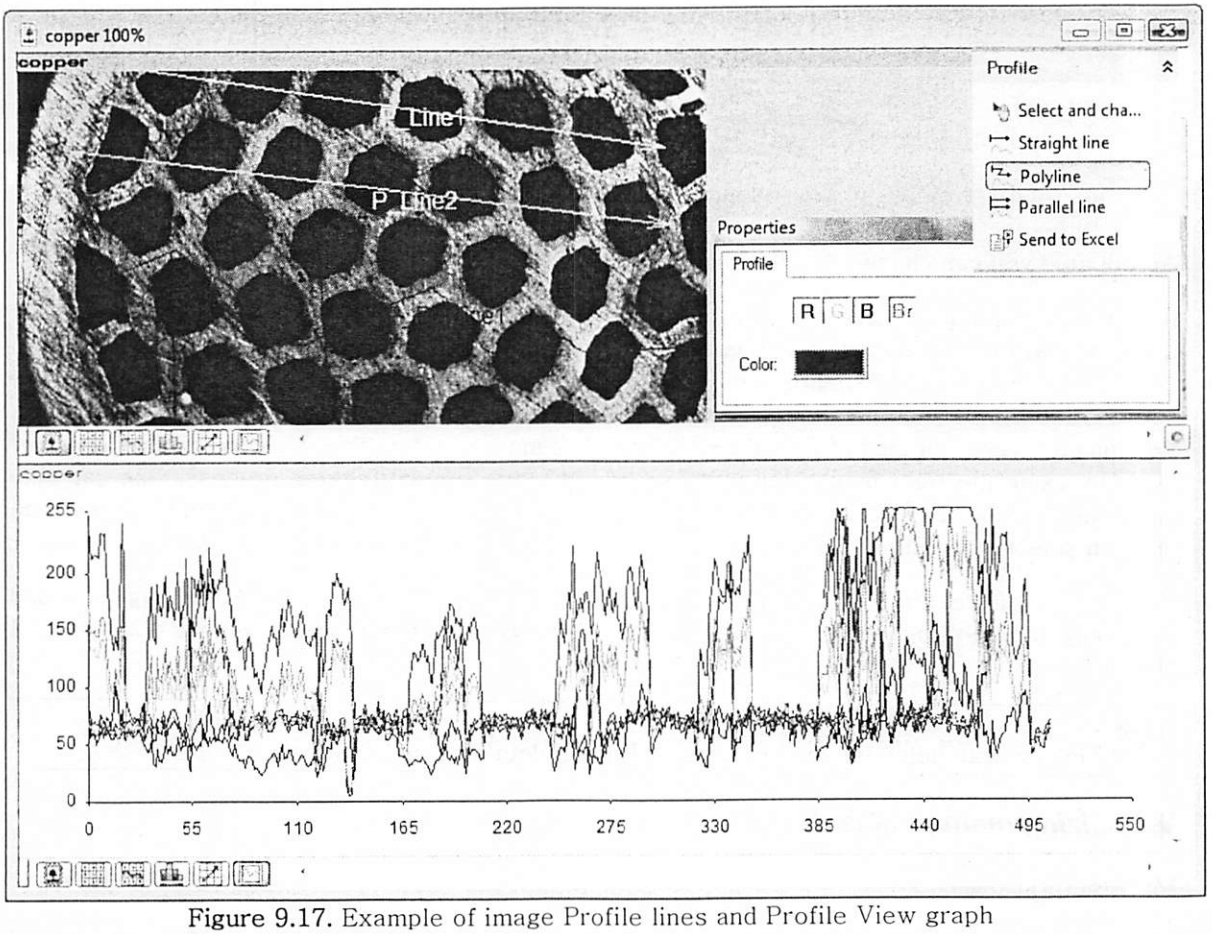


Figure 9.17. Example of image Profile lines and Profile View graph

Figure 9.17 shows an example of the three types of Profile lines in the active image. In the pane below is a corresponding intensity graph displayed in Profile View. The graph is only for the pair of parallel lines labeled "P_Parallel1." The graphs for the other two line types are not displayed. The line labeled P_Parallel1 is selected in the Select and change command. The Properties window shows that all four channel values for each of these two parallel lines are selected for display in the chart.

Working with Profile lines

To create lines and to modify the lines and the graph values displayed, open the Measure➢Profile menu and select the appropriate command.

To create a line, select the command for the line type. Start the line by left clicking and dragging. The graph appears and changes in real time as you draw the line. Lines are numbered sequentially, with a separate numbering sequence for each type of line.

Creating a straight line

Left click and drag, then let go to end it.

Creating a parallel line

Left click and drag the line to the desired end point, then move the cursor perpendicular to the line to separate the line into two parallel lines. Left click to end it.

Creating a polyline

Use this command to draw an open or closed polyline or polygon shape. A polyline can include straight line segments and smooth contours. The vertexes are set by left mouse-button clicks. To create a polygon, click the left mouse button at each vertex in the polygon. Create smooth edges by holding the mouse button down while dragging the mouse cursor. Right-click to end the polyline.

Tip: Use the profile tool in the **Tool List** for faster access to commands.

Deleting lines

Select the line and press the Delete key.

Moving lines

Click on the line. The line is highlighted and the cursor becomes a hand, showing that you are in "moving mode" for that line. The graph changes accordingly in real time as you move the position of the line. Click outside the line to exit this mode. A line's position can be moved at any time. To move multiple lines together, select multiple lines using Ctrl-click.

Modifying lines

To change a line's length, orientation, or shape—as well as the values chosen for display in the graph—select the **Measure≫Profile≫Select and change** command, then click on the line. Alternatively, click on the line first, then select **Measure≫Profile≫Select and change**. You can now move the line's end points or vertices and therefore change the length, angle, or shape of the line. The graph will change in real time as you modify the line.

While in "**Select and change**" mode, the position of a line can also be moved in the normal way at any time.

Parallel lines: Drag the handles to change the length and angle of the two lines and to change the distance between them.

Polylines: Drag the vertex points individually to change the line shape.

Exiting: To exit "**Select and change**" mode, click anywhere on the screen outside the active image. This will close the **Properties** window for the **Profile** command. Now you can draw new lines from the **Measure≫Profile** menu again. You can also exit "**Select and change**" mode by directly opening the **Measure≫Profile** menu.

Line colors

Each line is drawn in a different color. Once a line is drawn, the color for a new line will change. The new color is displayed in the color box in the **Profile** tab. Colors for drawing new lines can be changed by clicking on the color box.

A line's color can also be changed later with the **Measure≫Profile≫Select and change** command. The **Properties** window will appear and a new color can be chosen. Click on the line, then the color box.

Graph properties for a line

If only one color channel is chosen, the graph color for that line becomes the same color as the line color. Multiple channels for a line are always colored in the graph with their designated channel colors of red, green, blue, or gray.

By default, the channels currently selected in the **Properties** window will be the ones displayed in the graph for each new line drawn. When channel selection is changed, all new lines will display these selected channels in the graph. For a new active image or new image document, the default channel selection is the last selection used when drawing a line.

To stop displaying a line's graph, open the **Measure➤Profile➤Select and change** command and de-select all channels in the **Profile** tab of the **Properties** box.

Export to Excel

Select Image View as the active view. Open Excel. Choose the **Measure➤Profile➤Send to Excel** command. Measurement data and statistics for all lines are exported.

Exporting measurement data

There are several possible ways to export measuring data for further processing. To accomplish this export task it is necessary to activate Object View or Statistics View.

1. **Export to file.** Run **File➤Save as...** command and select **txt** file extension for save measurement data in the tabulated ASCII text file.
2. **Export to clipboard.** From the active Object View or Statistics View simply execute the **Edit➤Copy** menu command. In this case tabulated data will be stored in the clipboard and can be pasted in the Excel program, or other programs.
3. **Export to Excel.** By command **File➤Export to Excel** measurement data will be transferred directly to the Excel program.

Chapter 10 - Printing

The program allows you to create a variety of customized reports to display your information. You can use the **Report Template** documents to create customized reports displaying charts, tables, images with or without overlays, or other objects, including OLE-objects such as an MS Excel spreadsheet.

This chapter describes how to design a Report Template and how to print a report using a Report Template, including:

- Report Template document
- Report Template window
- Report pages
- Report objects
- Assign report template
- Report preview
- Printing using report template

Report Template document

The Report Template document is one more document type that is supported by the program. The document of this type can be used in two modes: as a report template and as a report itself.

- **Report Templates** allow you to design reports using placeholders for tables, charts, images, and other objects. You can save a template and use it many times as you need.
- **Reports** insert data from your most recent session into the placeholders. These reports can be updated from session to session, and printed to a printer.

Each Report Template document has its own document window. You can find more details about the document windows in Chapter 4. The report template document is displayed in the Report View to represent document data. The Report View allows you to manipulate the report contents, i.e. to insert objects into the report pages, remove objects from pages, add/remove pages into/from the report, etc. You will find more details about report windows and how to work with them below in this chapter.

You may work with report template documents in the same manner as it is described in Chapter 4 - Program Base, **"Working with documents"**. The procedures described there allow you to carry out the following action with report template documents:

- Open templates
- Close templates
- Reload templates
- Save templates
- Save as new templates

Creating a new Report Template

If you want to design a new report template choose the **File➤New Report** command. After the command is performed, a new default report template document will be created and displayed in a new window. It is not necessary to close the working report to create a new one.

Opening Report Templates

The Report Template document can be opened by using the **File➤Open...** command, or as a recent file. You can find the description of this procedure in Chapter 4.

The program allows you to store your report template document to a native file format that has the rpt extension.

If you want the list area of the "**Open**" dialog box to contain only report template files, you need to select the appropriate type of files in the **Files of type** combo box: Report Document (*.rpt).

After the report template document is loaded it will be displayed in the new report window.

Saving Report Templates

You can store your Report Template document as described in Chapter 4. If your report is not saved yet, the "**Save As**" dialog box will appear. Then you need to type a desired file name in the **File name** field. Report file extension will be added automatically.

Report Pages

Any Report Template document contains one or more **pages**, each of which represents a sheet of paper. You can also add or remove pages from the report. At any moment in time, the Report View of the report window can show only one page, called "active", but you can activate any page in the report. The newly created report contains only one page.

The following annotation objects can be inserted into the report pages:

- **Line**, which represents a simple straight lines and arrows;
- **Spline**, which represents spline lines or spline shapes;
- **Polyline**, which represents polygonal lines or polygonal shapes;
- **Rectangle**, which represents rectangular shapes;
- **Ellipse**, which represents elliptic shapes;
- **Text label**, which allows you to put text labels.

You can also insert other types of objects that help you to represent your data:

- **View placeholder**, which represents placeholders for charts, images, measurements data sheets and other program objects in the report;
- **OLE-objects**, which allows you to insert into report registered OLE-objects such as an MS Excel spreadsheet.

You draw objects and placeholders on the report pages during report template designing.

Adding pages

You can add as many pages into your report as you need. To do it, choose one of the following

menu commands:

- Report➢Insert page ➢before current page adds a new page **before** the currently active page
- Report➢Insert page ➢ after current page adds a new page **after** the currently active page

Another way to execute one of these commands is to press appropriate buttons in the "Report" toolbar.

These commands are always available in the Report View mode.

Removing Pages

You can remove a currently active page from the report by choosing the **Report➢Remove page** menu command or by pressing an appropriate button on the "Report" toolbar. This command is available when the report contains more than one page.

Activating Pages

You can change the report's active page by choosing the **Report➢Previous page** and the **Report➢Next page** menu commands by pressing the appropriate buttons in the "Report" toolbar. The active page name is shown in **View Header** of Report View. These commands are available when the report contains more than one page.

Tip: For more convenient work with report documents it is recommended to activate a special toolbar. To do this, just click the right mouse button in the toolbar area at the top of the **Main window** to call **Toolbar's Context Menu** and select "Report" toolbar.

Page Settings

You can change the size of paper you want to use to print your report, and change the printed area and orientation of your report page by using the **File➢Page Setup...** menu command. This command displays the Windows standard "**Page setup**" dialog box.

You can find an example of this dialog box in **Figure 10.1.**

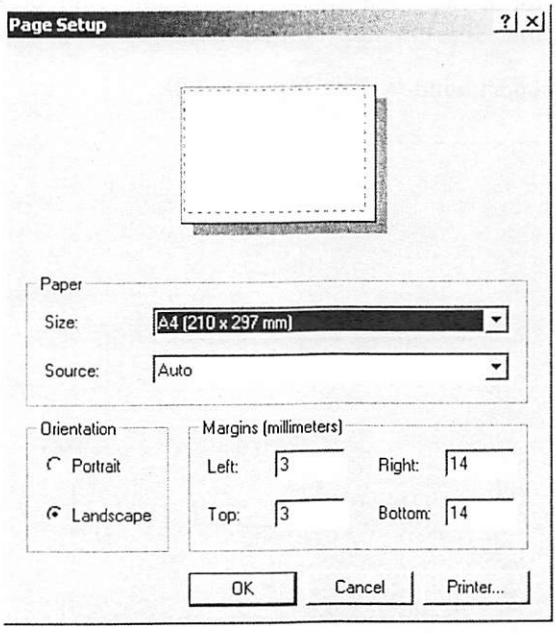


Figure 10.1. An example of the "**Page setup**" dialog box.

This figure shows the following:

- **Paper** group box contains controls that allow you to manage the paper:
  - **Size** field lets you specify the size of the paper that will be used to print your report,
  - **Source** field lets you specify where the paper you want to use is located in the printer.
- **Orientation** group box controls lets you specify the report page orientation:
  - **Portrait** lets you specify how your report will be positioned in the printed page.
  - **Landscape** lets you specify how your report will be positioned in the printed page.
- **Margin** group box contains controls that allow you to specify the printed area of the page:
  - **Left** field shows the width of nonprinting area on the left side of the report page.
  - **Right** field shows the width of nonprinting area on the right side of the report page.
  - **Top** field shows the height of nonprinting area at the top of the report page.
  - **Bottom** field shows the height of nonprinting area at the bottom of the report page .
- Click the **OK** button to close the dialog and apply changes you have made to the report pages.
- Click the **Cancel** button to close this dialog without applying the changes you have made.
- Click the **Printer** button to change your printer settings.

Report Template window

The Report Template document can be displayed in its own document window. This window may have only the **Report View** to represent report data. Here the window of the report template document will be called the *report window.*

The report window allows you to design and modify the report template using annotations, OLE objects, and placeholders for tables, charts, images, graphs, and other objects. You can also insert or update data from your session into the placeholders, and print a report.

Here is an example of the report window (see **Figure 10.2**).

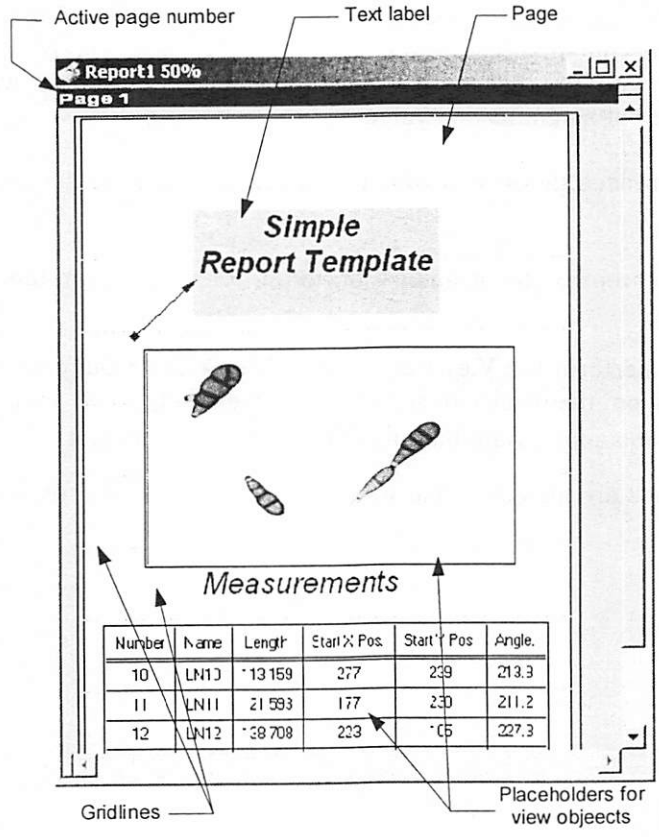


Figure 10.2. An example of the **Report View** of report window.

Although a report may have several pages, the report window can display only one active page at any moment. **View Header** of the Report View shows an active page number (Page 1, Page 2, etc...). After you activate another page in the report template the **View Header** will display a new page number.

The report window displays a page in the form of a sheet of paper. A part of paper that can be printed has a white color, and a nonprinting part (printer margins) has a gray color. The paper size and margin values are determined by the printer page settings.

A set of commands and tools are available in Report View, including:

- Zooming in / out tools,
- Annotating tools,
- Printing tools (OLE- insert and modify objects and placeholder data, change printer settings, print preview, etc.).
- General commands

All these commands and tools are discussed below in this chapter. This section will explain how to set the report window to get help to design reports.

Zooming In and Out

Use the zooming commands to magnify or reduce the appearance of the report page on the Report View. The zooming commands do not change the actual size of the report page, they simply enlarge or reduce your view of the report page by the specified percentage. The current magnification appears in the document window **title bar**.

The zooming commands have fixed magnification of 1% to 1600% of the original. The whole magnification sequence contains 10, 25, 50, 100, 200, 400, 800, 1600% values. The following two commands allow you to change the magnification in the report window in sequence, beginning from the current magnification value:

- **View≫Zoom In** increases the magnification to the next one in the sequence, beginning at the current one
- **View≫Zoom Out** decreases the magnification to the previous one in the sequence, beginning at the current one

An alternative way to perform the **View≫Zoom In** or **View≫Zoom Out** commands is to press the [+] or the [-] keys on the Numpad keyboard, respectively. You may also execute these commands by clicking the appropriate buttons (and) in the toolbar.

The following commands are also available when a report window is active:

- **View≫Zoom 10%**,
- **View≫Zoom 25%**,
- **View≫Zoom 50%**,
- **View≫Zoom 100%**,
- **View≫Zoom 200%**,
- **View≫Zoom 400%**,
- **View≫Zoom 800%**,
- **View≫Zoom 1600%**.

These commands allow the Report View to display the report page with the given magnification. You can select any of them by choosing the corresponding menu item. Another way to execute the **View≫Zoom 100%** command is to press the [/] key on the Numpad keyboard. You may also perform this command by clicking the button on the toolbar.

You may also use the **Zoom** tool to magnify or reduce the appearance of the report page in the report window.

To use the **Zoom** tool, click the button on the toolbar, and move the cursor into the report window. The cursor will change into a magnifying glass with "+" inside it.

- You can increase the magnification to next in the sequence by clicking the left mouse button in an area of the report page. You can continue to click until the magnification is increased to the upper limit of the sequence, which is 1600%. This method gives the same result as using the **View≫Zoom In** command.
- You can decrease the magnification to previous in the sequence by placing the magnifying glass anywhere in the report page area and clicking the left mouse button while holding down the [SHIFT] key on the keyboard (while you hold down the [SHIFT] key on the keyboard the mouse cursor will look like a magnifying glass with "-" inside it). You can continue to click until the magnification is reduced to the lower limit of the sequence, which is 1%. This method gives the same result as using the **View≫Zoom Out** command.

- If you want to magnify an area of the report page, place the magnifying glass in the desired position on the report window and press the left mouse button. Then holding down the left mouse button, drag the mouse cursor to resize the drawn rectangular area. After that, release the left mouse button to zoom in on this area. This method allows you to set any magnification value from 100% to 1600%.

Fit to window

The **View➤Fit to window** command adjusts the magnification ratio so that the **entire** report page is displayed in the report window. You may also perform this command by pressing the [*] key on the Numpad keyboard.

Fit to page

The **View➤Fit to image** command adjusts a report window size to fit the size of the report page as currently displayed.

Gridlines

As you can see in **Figure 10.2** the report window displays **gridlines** on the report page view. They can help you to set placeholders and other objects positions and sizes.

Note The **gridlines** will not be printed on your report.

You can enable or disable **gridlines** by setting the **Show grid on the page** flag in the "**Report**" tab of the "**Preferences**" tab dialog. The "**Report**" tab also allows you to change a grid step. To show this dialog you need to choose the **File➤Preferences...** menu command as it was described in Chapter 4 - Program Base, "Options and Settings".

Report objects

You can use the annotation tools to add text labels, lines, ellipses, and other shapes to your report. You can find the annotation tools in the **Edit➤Annotate** popup menu. These tools also let you manipulate already-drawn objects to customize the report.

These are the following annotation tools and commands that can be used in the Report View:

- **Edit➤Annotate➤Line** allows you to add straight lines and arrows to a report page.
- **Edit➤Annotate➤Polyline** allows you to add any polygonal lines or polygonal shapes to a report page.
- **Edit➤Annotate➤Spline** allows you to add spline lines or spline shapes to a report page.
- **Edit➤Annotate➤Rectangle** lets you put rectangular shapes on a report page.
- **Edit➤Annotate➤Ellipse** allows you to put elliptical shapes on a report page.
- **Edit➤Annotate➤Text label** allows you to put text labels on a report page.
- **Edit➤Annotate➤Select** allows you to select the previously drawn object and modify it.

You can also insert OLE objects, placeholders for images, charts, measurements data, and other data to the report using the following commands:

- **Insert placeholder** allows you to add placeholders for charts, images and other program

objects in the report.

- **Update placeholder data** is used to update data in the selected placeholders.
- **Insert OLE object** is used to insert OLE objects into a report page.

The commands mentioned above are available in Report View. The **Edit➢Annotate➢Select** command also requires at least one object on a report page. The **Report➢Update placeholder data** command also requires at least one placeholder on a report page. The results of all these commands, excluding the **Report➢Update placeholder data** command, can be discarded by using the **Edit➢Undo** command.

View placeholder

Placeholder is a special object for representing and existing view in the report. Thus you can insert in your report an image, chart, or measurement and class tables.

Insert placeholder

For inserting a placeholder into a report you have to use **Report➢Insert placeholder** menu command. This command is enabled only then there is an active report document. After entering this mode, a "**Properties**" dialog will appear (see **Figure 10.3** for reference).

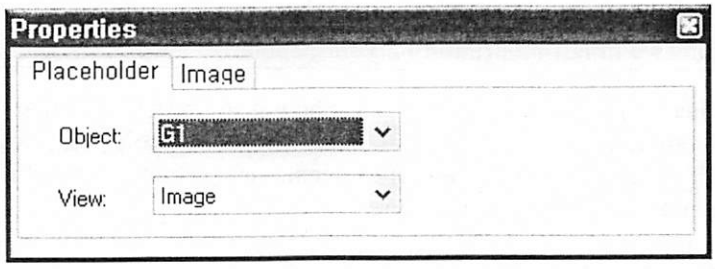


Figure 10.3. An example of "**Properties**" dialog.

This figure shows the following:

- **Object.** You can select an image object currently present in the program.
- **View.** Type of desirable view can be selected by this control.

After setup of desirable placeholder settings you just have to draw a bounding rectangle for the new placeholder. You can change placeholder size, position, and settings later with help of the **Edit➢Annotate➢Select** command.

Update placeholder data

If a placeholder displays out-of-date information because of some changes of the corresponding image object, you can refresh a selected placeholder by the **Report➢Update placeholder data** command.

Report objects modifying

You may change all annotation objects in your report page. To do this, select the desired objects first, using the **Select** tool. After the object reference points are drawn by white squares, you can change the object by dragging these points. You may also move the whole selected object or several selected objects by dragging any part of any selected object, excluding the reference points.

If only one drawing object is selected, the "**Properties**" tab dialog will be displayed. This dialog

contains tabs that allow you to change object properties, as during object creation. The tab number and type depends on the selected object.

The menu commands **Edit➢Copy**, **Edit➢Paste** can be used to manipulate the selected objects. These commands allow you to copy the selected annotations to the Windows Clipboard and paste a new copy of them to the active image. You can perform the same actions by using the [CTRL] + [C] and [CTRL] + [V] shortcut keys. The **Edit➢Delete** commands remove the selected objects. Do the same by pressing the [DELETE] key on the keyboard.

OLE objects

The program allows you to insert OLE-objects registered in OS Windows into a report document by using the **Report➢Insert OLE object** command.

Insert OLE object

To insert an OLE object in the active page you need to select the **Report➢Insert OLE object** command first. After you draw the bounding rectangle, the standard Windows "**Insert Object**" dialog box containing the list of registered OLE objects will be displayed. You can find an example of this dialog in **Figure 10.4.a** and **Figure 10.4.b.**

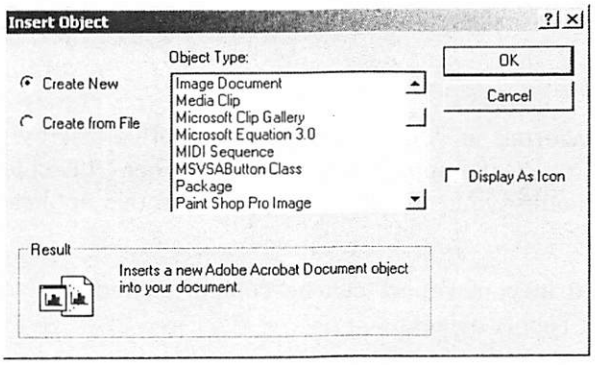


Figure 10.4.a. An example of the "**Insert Object**" dialog box.

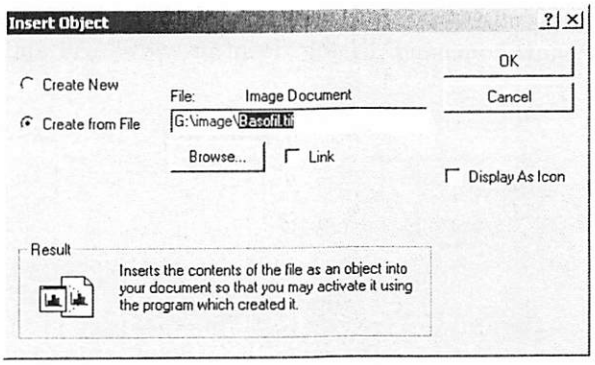


Figure 10.4.b. An example of the "**Insert Object**" dialog box.

This figure shows the following:

- The **Object Type** control provides a list of all the types of objects supported by other applications installed on your system. You need to highlight the type of an object you want to create.
- Click the **Create New** button to insert a new object of the selected type into your report page.
- Click the **Create from File** button to insert an object from the selected file into your report

page.

- **File** displays the selected files name. You can specify the file name by entering it in this field.
- Click the **Browse** button to search the available object files.
- Check the **Link** box to create a link between the object file and the report where it will appear. Otherwise, the new object will be inserted into the report.
- Check the **Display As Icon** box if you want your report to display the selected object as an icon or placeholder.
- Click the **OK** button to insert a new object and return to the report page.
- Click the **Cancel** button to break the **Report≫Insert OLE object** command and return to the report template.
- Click the **Help** button to access the online Help files.

After you choose the desired object type or object file you can click the **OK** button to a new object and return to the report page.

OLE-object modifying

Once an OLE object is inserted in your report you can activate it by double-clicking the left mouse button on it. As a result, the application supporting your OLE object type will start. Using this application you can modify your object. After you close this application, your object will be updated.

The OLE objects inserted in your report can be copied, pasted, resized, and removed by the same method as the other report objects.

Printing using the Report Template

A created report document can be printed. Before printing you may preview your report by running the **File≫Print preview** command. Dialog "**Print preview**" will appear (see **Figure 10.5** for reference).

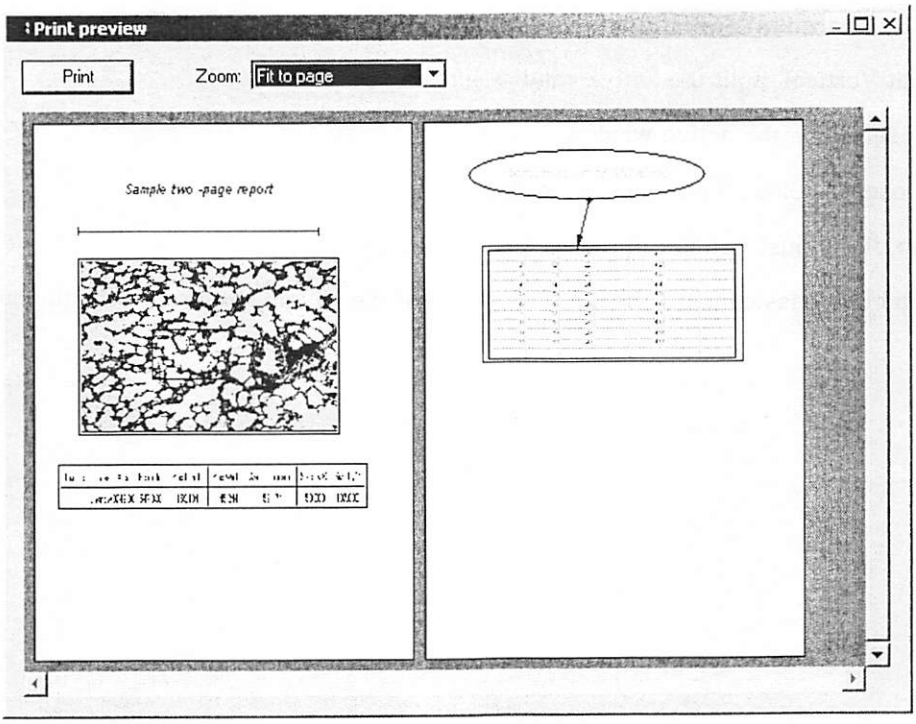


Figure 10.5. An example of the "Print preview" dialog.

On this dialog you can select the desired zoom factor by **Zoom** control. If you find that your report looks good you may print it from this dialog with the **Print** button. It is equivalent to the **File➢Print...** command. When you select printing by any other way, a standard "Print" dialog will appear (see **Figure 10.6**).

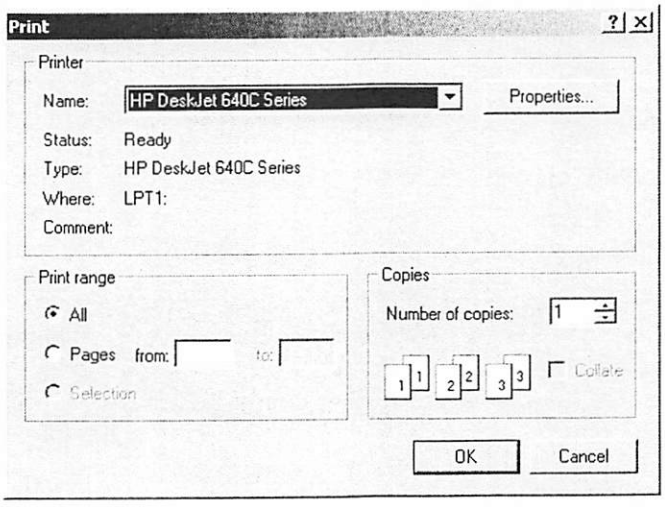


Figure 10.6. An example of the "Print" dialog.

In this dialog you may select a printer, setup your printer settings, and start the printing process with the **OK** button.

Window

The **Window** menu has the same function as the Windows standard. Added original commands are:

Window➢Split Horizontal: Split the active window into two parts horizontally.

Window➢Split Vertical: Split the active window into two parts vertically

Window➢Close: Close the active window.

Window ➢Close All: Close all the opened windows.

Window➢Next/Previous: Activate the next or previous window.

Window➢Load UI: Classic means the earlier version of the UI and **Modern** means the current UI.

Chapter 11 - Tools and Commands Reference

This chapter describes all of the menu commands. They are organized by the menu in their order of appearance on the menu bar (from left to right).

File menu

Use the File menu commands to open, save, print, and close your work, to change the program general preferences, to create new images and report templates. This menu also contains commands that allow you to change your printer settings, to see a preview of the your reports before printing it, to see a preview of your images or other data before printing it without the report templates, to print your document with or without using of the report templates. At the bottom of the File menu you can find the list of the recently opened files.

New Image...

File➢New Image... [CTRL] + [N]
Function: Create a new image document and a new image within it.
Description: Using this command you can create a new image document and a new empty image within it. This command displays the "New image" dialog box that allows you to specify the dimension, pixel depth and color model of the new image. After the command is performed and a new image together with its document is created successfully the new image window will be created, and it will display the newly created image.

New Report

File➢New Report
Function: Create a new report template document.
Description: Use this command to create a new report template document. The just created report document has only one page. If this command is performed successfully the new report window will be created, and it will display the active page of the report.

Open...

File➢Open... [CTRL] + [O]
Function: Load an image, image sequence or reports.
Description: Use this command to load images, image sequence, or reports from the existing files. It shows the "Open" dialog, in which you can select the path and file you want to load. After you open an image or report, the program places it into a new window, which becomes active. The File➢Open... command also allows you to load several files simultaneously.
This command can also be used to preview the image, or to view its statistics and information without actually loading the image itself, that lets you locate a particular image quickly.

Reload

File➢Reload [CTRL] + [R]
Function: Close the active document (image, image sequence or report) and load it again.
Description: This command shows prompt to ensure you want to reload the active document. If you confirm your wish it closes the active document and loads it again. All previous changes of this document will be discarded.

Save

File➢Save [CTRL] + [S]
Function: Save the active document changes to the existing file.

Description: This command allows you to store the active document changes to the existing file. If your document is not saved yet, this command will provide the same action as the File➢SaveAs... command.

Save As...

File➢Save As...
Function: Save the active document or its part to a file with a name and path that you will specify, in the format that you will specify.
Description: This command allows you to store the active document or its part to a file with the specified name, path and format. It displays the "Save As" dialog box, in which you can choose the path to save a file, type a new file name and choose the file format. Depending on the chosen file format this command lets you store an entire document, single image, image sequence, image info, drawing object, measurement and statistical data, chart data, report and report template, etc. If this command stores the entire document and is completed successfully, the document will change its name to a new one.

Print...

File➢Print [CTRL] + [P]
Function: Print the active report or print the active document view (image view, measurement or statistics view, and chart view) without using a report template.
Description: Use this command to print one or more copies of the active report or the active document view to the selected output device. This command shows the standard "Print" dialog that lets you take full advantage of your printer capabilities.

Print preview

File➢ Print preview
Function: Preview the active report or active document view before printing.
Description: Use this command to preview the active report or the active document view before printing. This command displays the "Print preview" dialog box that shows how the report pages will look like before you print them.

Page setup...

File➢Page setup...
Function: Change the page layout settings for the selected printer.
Description: Use this command to access the standard Windows "Page setup" dialog box for the printer you have selected. You can change the page layout settings using the controls in this dialog and can change the selected printer and its settings.

Export to Excel

File➢Export to Excel
Function: Send data from the active view to Excel.
Description: By this command it is possible to send into Excel information provided by a view. In the case of Image View, common information about the image will be transferred. For Object View or Statistics View tabulated measurement or statistics data will be sent to Excel correspondingly. This command is view dependent, thus you have to activate a view before execution.

Export to Excel gray image data

File➢Export to Excel gray image data
Function: Send brightness image data to Excel.
Description: Command can be used to analyze brightness values of image pixels. Each cell in

Excel sheet will contain information about one pixel of an image.

Preferences...

File➢Preferences...
Function: Change the program general preferences.
Description: This command displays the "Preferences" tab dialog box. Using the controls in the dialog tabs you can change the general preferences of the program.

Exit

File➢Exit [ALT] + [F4]
Function: Quit the application; prompt to save changed documents.
Description: You can use this command to leave the program and return to Windows. The program will prompt you to save your modified documents before this command will be performed.

Recent Files

File➢ {Recent files names}
Function: Open a file with a name displayed in this menu item.
Description: This menu command loads recently used files. If this file is already opened this command performs nothing. In other case it chooses a document type based on file extension, creates a new document and loads file contents to this document.

Edit menu

You can use the Edit menu commands to undo or redo again the most recent commands, to copy your images, ROIs, drawing objects, measurement data from data sheet to the Window Clipboard, and to paste Clipboard contents to an image window. The Edit menu also contains commands that allow you to remove the selected objects or all objects from your image or report page.

Undo

Edit➢Undo [CTRL] + [Z]
Function: Undo the most recent commands.
Description: You can use this command to revert to the state of the program before the most recent commands were performed. Most of the program commands can be undone. The depth of the undo stack defines the number of commands that can be undone. You can change it in the "General" tab of the "Preferences" tab dialog, which can be displayed using the File➢Preferences... command.

Redo

Edit➢Redo [CTRL] + [Y]
Function: Perform again the previously undone commands.
Description: You can use this command to perform the previously undone commands (by the Edit➢Undo command) again.

Copy

Edit➢Copy [CTRL] + [C]
Function: Copy an image, an image ROI, measurement objects, annotation objects, measurement or statistical data, statistics chart to the Windows Clipboard.
Description: This command places the contents of image ROI or the entire image, statistics chart, annotation or measure object, measurement or statistical data to the Clipboard, leaving the

original data, image, or object intact. Copied contents remain in the Clipboard until they are displaced by new contents. You can paste the same contents multiple times without recopying the original item.

Paste

Edit➢Paste [CTRL] + [V]
Function: Retrieve data, images, or drawing objects from the Windows Clipboard.
Description: This command retrieves the item most recently cut or copied to the Windows Clipboard and places it into the active image or report page. Note: that items remain in the Windows Clipboard until displaced by the next cut or copied item. You can paste the same Clipboard contents so many times as you need.

Paste New

Edit➢Paste New
Function: Retrieve images or drawing objects from the Windows Clipboard and place them into a new image.
Description: Use this command to place the contents of the Windows Clipboard into a new image. After a new image is created, it becomes an active image. The pixel depth and color model of the new image will be the same as that of the original image. If a nonrectangular ROI or drawing object is copied into the clipboard, the program uses its bounding box for the new image.

Delete

Edit➢Delete [DEL]
Function: Delete the selected objects from the active image or active report page.
Description: Use this command to remove the selected objects from your image or report page.

Delete All...

Edit➢Delete All...
Function: Delete all objects from the active image.
Description: This command shows the "**Delete all objects**" dialog box, which contains the types of objects that may exist in your image. After you choose the types of objects you want to remove, and close this dialog by clicking the **OK** button, the objects with the selected types will be deleted from your image.

Annotate

The **Edit➢Annotate** menu commands allow you to draw any annotate objects in the active image or in the active report page. They also let you change the properties, position and dimension of the existing objects, burn the drawings to the image the way they become the permanent part of the image.

Select

Edit➢Annotate➢Select
Function: Select the previously drawn annotation object in the active image or report page to change or move it.
Description: You can use this command to select an annotation object. After that you can change its position or shape. You can also change the selected object properties using the "**Properties**" tab window that will be displayed when you select a *single* object. The number and contents of the tabs depend on the object.

Note: If you select several annotation objects the "**Properties**" tab window will be hidden.

Line

Edit➢Annotate➢Line
Function: Draw a new straight line or arrow in the active image or in the active report page.
Description: You can use this command to draw straight lines in the active image or in the active report page. Using the settings of this command you may define the following line properties: color, width of your line, and types of end points of the line. Changing the types of the line end points allows the straight line to look like an arrow.

Note: You must set the desired line properties before drawing a new line. Later you can change your line properties by using the Edit➢Annotate➢Select command.

Spline

Edit➢Annotate➢Spline
Function: Draw a new spline line or shape outlined by a spline in the active image or in the active report page.
Description: This command allows you to draw closed or open-ended shapes outlined by a spline in the active image or in the active report page. Using the settings of this command you may define the shape properties: background and foreground colors, width of contour, types of the end points, filling mode.

Note: You must set the desired spline properties **before** drawing a new object. Later you can change your spline properties by using the **Edit➢Annotate➢Select** command.

Polyline

Edit➢Annotate➢Polyline
Function: Draw a new polyline or polygon shape in the active image or in the active report page.
Description: This command allows you to draw closed and open-ended polyline or filled or thin polygon shapes in the active image or in the active report page. Using the settings of this command you may define the shape properties: background and foreground colors, width of outline, types of the end points, filling mode.

Note: You must set the desired polyline properties **before** drawing a new object. Later you can change your polyline properties by using the **Edit➢Annotate➢Select** command.

Rectangle

Edit➢Annotate➢Rectangle
Function: Draw a new rectangular shape in the active image or in the active report page.
Description: Use this command to draw filled or thin rectangular shapes in the active image or in the active report page. Using the settings of this command you may define the following shape properties: background and foreground colors, width of contour, filling mode.

Note: You must set the desired rectangle properties **before** drawing a new object. Later you can change your rectangle properties by using the **Edit➢Annotate➢Select** command.

Ellipse

Edit➢Annotate➢Ellipse
Function: Draw a new elliptical shape in the active image or in the active report page.
Description: You can use this command to draw filled or thin elliptical shapes in the active image

or in the active report page. Using the settings of this command you may define the following shape properties: background and foreground colors, width of contour, filling mode.

Note: You must set the desired ellipse properties **before** drawing a new object. Later you can change your ellipse properties by using the **Edit➢Annotate➢Select** command.

Text label

Edit➢Annotate➢Text label
Function: Draw a new text label in the active image or in the active report page.
Description: This command allows you to draw new text labels in the active image or in the active report page. Using the settings of this command you may define the following properties: background and foreground colors, text, used font attributes, opaque or transparent drawing mode, text alignment in the bounding box, etc.

Information...

Edit➢Information... [ALT] + [ENTER]
Function: Shows the active document properties.
Description: This command shows the **"Information"** tab dialog, the tabs of which allow you to see current active document (image or report) properties. For example, for image document this command shows the tab dialog box that contains the active image attributes, the spatial calibration applied to the image and the information about the file, in which the image is stored.

Acquire menu

The **Acquire** menu contains commands that allow you to capture images from TWAIN-compliant input devices as well as from image input devices.

Select TWAIN device...

Acquire➢ Select TWAIN device...
Function: Select a TWAIN-compliant scanner or capture device.
Description: Use this command to setup a TWAIN-compliant scanner or other input device for digitizing images. Once setup the device may be used to capture an image by selecting the **Acquire➢ Acquire from TWAIN device...** command.

Acquire from TWAIN device...

Acquire➢ Acquire from TWAIN device...
Function: Capture an image from the previously selected TWAIN-compliant scanner or other input device.
Description: You can use this command to capture an image from a scanner or other TWAIN-compliant input device that is previously selected by using the **Acquire➢ Acquire from TWAIN device...** command.

Note: This command will work only in conjunction with devices that have been previously installed on the host computer.

Image capture...

Acquire➢ Image capture...
Function: Capture an image or image sequence from the input device.
Description: Use this commands to capture an image directly from digital cameras or other image input devices (e.g., VCR). The **Acquire➢Image capture...** command shows a dialog box that helps

you to select the appropriate hardware and software drivers, and configure your setup correctly. Using this dialog you may monitor the image while you make camera and/or subject adjustments (refocusing, relighting, repositioning, and so forth). After you have configured your input device and place your subject as you want, you can manually or automatically capture an image from the continuous video flow.

Live measurements

Acquire➢Live measurements
Function: Switched on/off live measurement mode.
Description: Live measurement is special mode of an Image View. In this case live image preview is in the Image View and it is possible to make most of operations on the preview like on the static image. Most useful application is taking manual measurements on live preview.

Overlay settings

Acquire➢ Overlay settings
Function: Draw crosshairs and overlaid rectangular and circles on the live measurement view. Actual size is same as calibrated values
Description: This command is used to switch on/off drawing two special lines (vertical and horizontal) above live image that crossed in the center of the view. Draw rectangular and circles as Vector images.

Get image from PTP camera

Acquire➢ Get image from PTP camera
Function: Receive image from digital camera that supports PTP (Picture Transfer Protocol).
Description: Use this commands to obtain images from digital camera that can work with PTP communication protocol (see your camera's documentation to know how to activate this transfer mode).

Image menu

The Image menu contains commands that allow you to rotate, resize, flip your image, change the image pixel depth and color model, make the copy of your image or its part, annotate your image, select the image ROI, display the image histogram, pseudo-color grayscale images, view the image attributes. This menu also contains the Sequence popup menu that allows you to work with image sequences.

Mode

The Mode popup menu contains commands that represent the pixel depth and color model of the active image, and let you change them.

Grayscale

Image➢ Mode➢ Grayscale
Function: Convert the active image to grayscale image.
Description: Use this command to convert a color image to a grayscale image. The pixel intensity values are set by averaging the weighting values for the Red, Green and Blue components of each pixel. If the active image is grayscale the command menu item has a checkmark.

RGB

Image➢ Mode➢RGB
Function: Convert the active image to a color image with RGB color model.
Description: Use this command to change the active image color model to RGB. If the active

image color model is RGB the command menu item has a checkmark.

HSB

Image➢ Mode➢HSB
Function: Convert the active image to a color image with HSB color model.
Description: Use this command to transform the active image to a color image with HSB color model. The command menu item has a checkmark if the active image has HSB color model.

YUV

Image➢ Mode➢YUV
Function: Convert the active image to a color image with YUV color model.
Description: Use this command to transform the active image to a color image with YUV color model. The command menu item has a checkmark if the active image has YUV color model.

8 Bits/Channel

Image➢ Mode➢8 Bits/Channel
Function: Change an image pixel depth to 8bits/color channel.
Description: Use this command to change an image pixel depth to 8 BPP for grayscale images or 24 BPP for color images. The command menu item has a checkmark if the active image is grayscale 8 BPP or True Color (24 BPP) color image.

16 Bits/Channel

Image➢ Mode➢16 Bits/Channel
Function: Change an image pixel depth to 16 bits/color channel.
Description: Use this command to change an image pixel depth to 16 BPP for grayscale images or 48 BPP for color images. The command menu item has a checkmark if the active image is grayscale 16 BPP or 48 BPP color image.

Clone

Image➢Clone
Function: Make an exact copy of your image in a new, untitled image window.
Description: This command allows you to create a copy of the active image.

Crop ROI

Image➢Crop ROI
Function: Make a copy of the active image ROI in a new, untitled image window.
Description: You can use this command to create a new image, the contents of which is an ROI of the active image. If a non-rectangular ROI is active when the **Image➢Crop ROI** command is selected, the new image contents will consist of the pixels contained within the active image ROI bounding rectangle.

ROI

The ROI popup menu contains commands that allow you to define an ROI on the active image.

Rectangle

Image➢ROI➢Rectangle
Function: Define a square or rectangular ROI in the active image.
Description: Use this command to define a new square or rectangular ROI or append or deduct a square or rectangular shape from the existing ROI in the active image depending on specified mode.

Arbitrary Rectangle

Image➢ROI➢Arbitrary Rectangle
Function: Define a square or rectangular ROI rotated to any angle (Arbitrary Rectangle ROI) in the active image.
Description: Use this command to define a new square or rectangular shape rotated to any angle in the active image. This shape will be a new ROI or will append or deduct from the existing ROI in the image depending on specified mode.

Circle

Image➢ROI➢Circle
Function: Define an elliptical ROI in the active image.
Description: This command allows you to define a new elliptical ROI or to append or deduct an elliptical shape from the existing ROI in the active image depending on specified mode.

Arbitrary Ellipse

Image➢ROI➢Arbitrary Ellipse
Function: Define an elliptical ROI rotated to any angle (Arbitrary Ellipse ROI) in the active image.
Description: This command allows you to define a new elliptical shape rotated to any angle in the active image. This shape will be a new ROI or will append or deduct from the existing ROI in the image depending on specified mode.

Polygon

Image➢ROI➢Polygon
Function: Define a free-form ROI (Polygon ROI) in the active image.
Description: You can use this command to define a new free-form ROI in the active image or to append or deduct a free-form shape from the existing ROI in the image depending on specified mode.

Spline shape

Image➢ROI➢Spline shape
Function: Define a spline outlined ROI in the active image.
Description: You can use this command to define a spline outlined shape in the active image that will be a new ROI or will append or deduct from the existing ROI in the image depending on specified mode.

Magic Wand

Image➢ROI➢Magic Wand
Function: Define an irregular ROI in the active image using the magic wand function (Magic Wand ROI).
Description: Use this command to define an irregular shape in the active image that will be a new ROI or will append or deduct from the existing ROI in the image depending on specified mode.

Resize...

Image➢Resize...
Function: Resize the active image to specified dimensions.
Description: This command allows you to resize the active image to a specified dimension. The bilinear scaling technique is used to resize the image that reduces the jagged edges.

Rotate

The **Rotate** popup menu contains the commands that allow you to turn the active image to a

specified angle or flip it along the horizontal or vertical axis.

180°

Image➤Rotate➤180°
Function: Turn the active image to 180°.
Description: Use this command to rotate the active image to 180 degree, so that the top right corner of the image becomes the bottom left corner, and the top left corner of the image becomes the bottom right corner. The result of this command is the same as of the consecutive performing of the **Image➤ Rotate➤ Flip Vertical** and **Image➤ Rotate➤ Flip Horizontal** commands.

90° CW

Image➤Rotate➤90° CW
Function: Turn the active image 90° clockwise.
Description: This command allows you to turn the active image to the angle of 90 degree to the right (in clockwise direction).

90° CCW

Image➤Rotate➤90° CCW
Function: Turn the active image 90° counterclockwise.
Description: This command allows you to turn the active image to the angle 90 degree to the left (in counterclockwise direction).

Arbitrary...

Image➤Rotate➤ Arbitrary...
Function: Turn the active image to a specified angle.
Description: Use this command to rotate your image to a specified angle. You can specify the desired angle and other settings in the dialog box that is displayed while this command performing.

Flip Vertical

Image➤Rotate➤ Flip Vertical
Function: Flip the active image in vertical direction.
Description: Use this command to flip the active image along its vertical axis, so that the top-right corner of the image becomes the bottom-right corner, and the top-left corner of the image becomes the bottom- left corner.

Flip Horizontal

Image➤Rotate➤ Flip Horizontal
Function: Flip the active image in horizontal direction.
Description: Use this command to flip the active image along its horizontal axis, so that the top-right corner of the image becomes the top-left corner, and the top-left corner of the image becomes the top-right corner.

Split...

Image➤Split...
Function: Separate color image into one or several grayscale channel images.
Description: Function can be used for extracting from a color image one or several color channels. For each selected color channel, a grayscale image is created. Desirable color channels can be selected in the "**Split image into color panes**" dialog that appears after executing this command.

Combine color panes...

Image➢Combine color panes...
Function: Generate color image from one or several grayscale channel images.
Description: This function is the reverse of the Image➢Split... operation. From one or several grayscale images, new color image will be created. This function has a settings dialog "Combine" in which desired channels can be activated and existing grayscale images can be assumed as channels to produce a color result. It is possible to specify the same grayscale image for several channels.

Combine images

Image➢Combine color panes...
Function: Combine two or more color images. Usually this is for fluorescent image combination.
Description: This function combines two color images into three modes – normal, RBG, fluorescent. The combined image can be combined again to another image.

Apply vectors

Image➢ Apply vectors...
Function: Makes the drawing vector objects on the overlay are permanently embedded into the image.
Description: This command makes already drawn annotations, measurement objects and manual measurement objects as permanent part of the image so that they cannot be changed later. Until you execute this command, your vector objects exist on a transparent overlay that is displayed on the top of your image.

Sequence

The Sequence popup menu contains commands that allow you to create a new image sequence and manipulate with the active image sequence.

Create new sequence

Image➢Sequence➢Create new sequence
Function: Create a new sequence using the selected images.
Description: Use this command to create a new image sequence and insert the previously selected images to it. This command is available only when the Context window contains at least two selected images. After the command is performed a new document will be created, a new image window will appear and the first image in the sequence (or frame) will be displayed in the window.

Remove frame

Image➢Sequence➢Remove frame
Function: Remove the current frame from the image sequence.
Description: Use this command to remove the currently active frame (it is displayed in the window) from the sequence. This command is available only when the image sequence has more than one image.

Next frame

Image➢Sequence➢Next frame
Function: Activate the next frame in the image sequence.
Description: Use this command to step the sequence to the next frame (it means this frame will be displayed in the window).

Previous frame

Image➤Sequence➤Previous frame
Function: Activate the previous frame in the image sequence.
Description: Use this command to step the sequence to the previous frame (it means this frame will be displayed in the window).

Play forward

Image➤Sequence➤Play forward
Function: Play the image sequence forward.
Description: Use this command to play the image sequence forward from the active frame to the last frame. This will not wrap around when the ending of the sequence is reached if the **Repeat** flag is not set by using the **Image➤Sequence➤Play repeatedly** command. This command is available only when the image sequence contains at least one frame after the current active one.

Play backward

Image➤Sequence➤Play backward
Function: Play the image sequence backward.
Description: Use this command to play the sequence backward from the active frame to the first frame. This will not wrap around when the beginning of the sequence is reached if the **Repeat** flag is not set by using the **Image➤Sequence➤Play repeatedly** command. This command is available only when the image sequence contains at least one frame before the current active one.

Play repeatedly

Image➤Sequence➤Play repeatedly
Function: Allows you to play the image sequence repeatedly.
Description: This command allows you to set or clear the **Repeat** flag for playing the image sequence. If this flag is set the image sequence can be played repeatedly, i.e. in this case the **Image➤Sequence➤Play forward** and the **Image➤Sequence➤Play backward** commands play the sequence and wraps around when the ending or beginning of the sequence is reached.

Histogram...

Process➤Histogram... [CTRL] + [H]
Function: Show or hide the **Histogram** window.
Description: Use this command to show or hide the **Histogram** window that displays the histogram of the active image.

Process menu

The **Process** menu commands let you process your images different ways. Using these commands you can colorize grayscale images, enhance images, adjust brightness/contrast/gamma for images, show histogram of the active image, threshold your images manually and automatically using different methods. This menu also includes a command that allows you to create a single image from several ones.

Filters...

Process➤Filters ... [CTRL] + [F]
Function: Filter the active image or ROI of the active image.
Description: This command shows the "**Image enhancement**" tab dialog, each tab of which contains one group of filters. The controls of the dialog lets you choose the desired filter,

change the settings for the selected filter, see preview of the filtered image. Using the selected filter you can modify the entire active image or its ROI. The "**Image enhancement**" tab dialog will be displayed until you close it or until the program has at least one opened image.

Brightness/Contrast...

Process➢Brightness/Contrast... [CTRL] + [B]
Function: Adjust brightness, contrast and gamma for the active image
Description: This command shows the "**Brightness/Contrast/Gamma**" dialog box. Using the controls of this dialog you can modify the intensity of the active image by adjusting brightness, contrast and gamma values for it.

Pseudo-color...

Process➢Pseudo-color... [CTRL] + [U]
Function: Colorize a grayscale image.
Description: You can use this command to show the "**Pseudo-color for Gray**" dialog box that allows you to choose the color palette and other settings to pseudo-color the active grayscale image. If the current active image is not grayscale, this command will be disabled. You can make grayscale image from current one by **Image➢ Mode➢ Grayscale** menu command.

Fast focus enahancement

Process➢Fast focus enahancement
Function: Combine individual unfocused images into a single, in-focus composite image.
Description: This command allows you to combine individual unfocused images into a single, in-focus composite image. Before you perform this command you need to select (enumerate) the unfocused images in the Context window.

Image tiling

Tiling is a very useful function when you need to create a high-resolution image of a big object with an area that exceeds the frame borders captured by the camera. If it is not desirable to decrease the magnification and miss some small important details, the tiling function helps to join several overlapped images acquired in series.

Auto Horizontal

Process➢Auto tiling➢Auto horizontal
Function: Make tiling of two or more overlapped images in horizontal direction.
Description: To accomplish a horizontal tiling task it is necessary to select in the Context window several images in order from left to right according to the original object parts layout. After selecting necessary images, the function **Process➢Auto tiling➢Auto horizontal** may be performed. Tiling will create a new image with the result.

Auto Vertical

Process➢Auto tiling➢Auto vertical
Function: Make tiling of two or more overlapped images in vertical direction.
Description: To accomplish a vertical tiling task it is necessary to select in the Context window several images in order from top to bottom according to the original object parts layout. After selecting necessary images, the function **Process➢Auto tiling➢Auto vertical** may be performed. Tiling will create new image with result.

Manual tiling

Function: Perform image tiling manually.

Description: Select the images for tiling before performing this command in Context window. This will make spaces for manual tiling and you can move the images manually.

Measure menu

The Measure menu commands let you perform spatial measurements upon your image, manually or automatically. Using these commands you can calibrate your images, take manual measurements in your images, select measurements and count objects in your images automatically, manually outline objects in your images, make statistical treatment of the measured data, and classify your objects.

Calibration

This set of commands allows you to manage calibration of images, create calibration markers, load and save calibration settings.

Calibration...

Measure➢Calibration ...
Function: Perform spatial calibration of your images.
Description: Use this command if you want to calibrate the spatial scale for your image. By default, the program expresses spatial measurements in terms of pixels, and you should use this command to change the terms in which spatial measurements will be reported. This command shows the "Calibration" dialog box. Using the controls contained in the dialog you can choose the desired calibration from the list of existing ones, create new calibration, modify already existing calibrations, add calibration markers to your images.

Auto/ semi auto calibration

Function: Perform calibration of your images.
Description: This command allows you to perform auto or semi auto calibration.

Create marker

Measure➢Calibration➢ Create marker
Function: Use this command to draw calibration marker on the image.
Description: By this command you can create new calibration markers on the active image according to currently selected calibration. In the "Properties" tab window of this command several setting of the marker can be set: font type, color and size, background type (transparent or not) and color, and the number of calibration units the marker will represent.

Save active...

Measure➢Calibration➢ Save active...
Function: Save currently selected calibration into own file.
Description: By this command you can save the currently selected calibration into its own file with a clb extension. This command is active only when active calibration is not Default. After the command executes, select an appropriate file name and location in standard "Save As" dialog.

Save all...

Measure➢ Calibration➢ Save all...
Function: Save all existent calibrations into file.
Description: By this command you can save all currently existent calibrations into a file with clb extension. This command is active only when there is at least one calibration except Default. After the command executes, select an appropriate file name and location in standard "Save As" dialog.

Open...

Measure➢ Calibration➢ Open...
Function: Open existent calibration file.
Description: Use this command for load existent file with program calibrations. Such file must have to have clb extension. After the command executes, select an appropriate file name in standard "Open" dialog. It is necessary to restart the "Calibration" dialog (if it was currently opened, of course) to take changes.

Manual measurements

The Manual measurements menu commands are useful for obtaining individual measurements. Using these commands you can define features that have measurements of their own (the length of a line, for example) or take measurements between two existing features (i.e. distance, angle). These commands also allow you to change the existing features later, and update measurements after you have changed your image calibration.

Select feature

Measure➢Manual measurements➢Select feature
Function: Select the previously drawn measurement feature in the active image to change or move it.
Description: You can use this command to select the existing measurement feature; after that you can change its position or shape. While the selected feature is changed, its own measurements will be updated. If some external measurements depend on the changed feature they will be updated too.

Point

Measure➢Manual measurements➢Point
Function: Define a new point feature in the active image.
Description: You can use this command to draw point features in the active image, which give you position measurements.

Straight Line

Measure➢Manual measurements➢Straight Line
Function: Define a new straight line feature in the active image.
Description: You can use this command to draw straight line features in the active image that gives you length measurements.

Circle by radius

Measure➢Manual measurements➢Circle by radius
Function: Define a new circle feature by radius in the active image.
Description: You can use this command to draw circle features in the active image. You have to specify the radius of the created circle. This feature gives you radius measurements.

Circle by diameter

Measure➢Manual measurements➢Circle by diameter
Function: Define a new circle feature by diameter in the active image.
Description: You can use this command to draw circle features in the active image. You have to specify the diameter of the created circle. This feature gives you diameter measurements.

Circle by 3 points

Measure➢Manual measurements➢Circle by 3 points

Function: Define a new circle feature traced by 3 points in the active image.
Description: You can use this command to draw three points in the active image and create circle features traced by them that gives you diameter measurements.

Rectangle

Measure➢Manual measurements➢Rectangle
Function: Define a new rectangular feature in the active image.
Description: You can use this command to draw rectangular features in the active image that gives you area measurements.

Polygon

Measure➢Manual measurements➢Polygon
Function: Define a new closed free-form feature in the active image.
Description: You can use this command to draw closed free-form features in the active image that gives you area measurements.

Polyline

Measure➢Manual measurements➢Polyline
Function: Define a new open-ended free-form feature in the active image.
Description: You can use this command to draw open-ended free-form features in the active image that gives you length measurements.

Spline

Measure➢Manual measurements➢Spline
Function: Define a new spline feature in the active image.
Description: You can use this command to draw spline features in the active image that gives you length measurements.

Lines from reference point

Measure➢Manual measurements➢ Lines from reference point
Function: Define set of straight lines with common point.
Description: By this command it is possible to create set of lines with common reference point. You can create as many lines as you need.

Auto trace

Measure➢Manual measurements➢ Auto trace
Function: Create polygon feature by automatic finding indicated edges.
Description: This command is used for creating closed free-form feature. There are two modes of this command: manual feature creation like in Measure➢Manual Measurements➢Polygon command and automatic edge finder that allows tracing an object boundary.

Angle

Measure➢Manual measurements➢Angle
Function: Define a new angle feature in the active image.
Description: You can use this command to create two connected lines with a common point in the active image, and measure the angle between them. The angle is measured from the first line to the second one, in a counter-clockwise direction. Note that this tool is different from the others measurement tools because you create two features first and then the measurement is taken. This feature gives you angular measurements.

Parallel lines

Measure➢Manual measurements➢Parallel lines
Function: Create line features parallel each other and measure distances between them.
Description: Using this command you can create line features that are parallel to each other, and measure distances between them. You can create as many line features as you want.

Perpendicular measurement

Measure➢Manual measurements➢Perpendicular measurement
Function: Measure perpendicular distances between points and lines.
Description: Using this command you can measure perpendicular distances from the base line.

Angle between 2 lines

Measure➢Manual measurements➢Angle between 2 lines
Function: Create an angular measurement between two line features.
Description: You can use this command if you want to measure an angle between two selected line features. Created feature gives you angular measurements.

Distance

Measure➢Manual measurements➢Distance
Function: Create a distance measurement between two selected features.
Description: Use this command to create a measurement of the distance between two selected features.

Send statistics to Excel

Measure➢Manual measurements➢Send statistics to Excel
Function: Send the results of measurement and images to Excel.
Description: Using this command you can send the results of measurement and images to Excel.

Manual tag

Measure➢Manual tag
Function: Manual tagging and counting of objects in the image by mouse clicking.
Description: Use this command to select object of some class or different classes in the image by mouse left button clicking. Each class of the objects has its own color and symbol, i.e. tag. Next class may be obtained simply by mouse right button click. Statistical data of the tag classes is shown in the special Manual tags View.

Report menu

The Report menu commands allow you to manipulate the active report or report template. Using these commands you can insert pages into the report, remove pages from the report, insert OLE-objects and placeholders for images, tables and other program data into report pages, remove them from report pages and modify them and their contents.

Insert page

The Insert page popup menu contains commands that let you insert pages into your report.

Before current

Report➢Insert page➢Before current
Function: Insert a new page to the report before the currently active one.
Description: Use this command to insert a new page to the active report. This page will be added

before the active one and will be activated, that means a newly created page will be displayed in the report window.

After current

Report➢Insert page➢After current
Function: Insert a new page into the report after the currently active one.
Description: Use this command to insert a new page to the report. This page will be added after the active one and will be activated, that means it will be displayed in the report window.

Remove page

Report➢Remove page
Function: Remove the active page from the report.
Description: This command allows you to remove the currently active page (it is displayed in the report window) from the report. Once the page is removed the next page will be activated. This command is available only if the report has at least two pages.

Next page

Report➢Next page
Function: Activate the next page in the report.
Description: Use this command to activate the next page in the report relative to the current active page. The active page is displayed in the report window, and you can insert any drawing objects or placeholders into it. This command is available only if the report contains at least one page after the current active one.

Previous page

Report➢Previous page
Function: Activate the previous page in the report.
Description: Use this command to activate the previous page in the report relative to the current active page. After this command is performed the new active page will be displayed in the report window, and you can make any manipulations with its contents: insert, remove, move and modify any drawing objects or placeholders within it. This command is available only if the report contains at least one page before the current active one.

Insert OLE object

Report➢Insert OLE object
Function: Insert a new OLE object into the report page.
Description: This command allows you to insert a new OLE object into the active report page. To make it you need draw a bounding rectangle, after that the standard Windows dialog containing the list of registered OLE objects will be displayed. Choose the desired one and close dialog by pressing the OK button. Then the selected OLE object will be placed into the report page. Double-click the left mouse button to activate and edit your object.

Insert placeholder

Report➢Insert Placeholder
Function: Insert a new placeholder for document view into the report page.
Description: This command allows you to insert a new placeholder for document view to the active report page. Placeholder represents a view of document window in a report; it means the placeholder can display an image with or without overlays, measurement data sheet, statistical data sheet, manual measurement data sheet, and chart. Using the settings of the Report➢ Insert Placeholder command you may choose the type of document view that you want to be represented by a placeholder, options for the chosen document view type and an image.

Update placeholder data

Report➢ Update placeholder data
Function: Update the selected placeholder contents.
Description: You need to use this command to update the contents of the selected placeholder when the image, measurement data or other data relative to the image selected in the placeholder was changed.

View menu

Use the View menu commands to magnify or reduce the appearance of an image in the active window. The zooming commands do not change the actual size of the image. They simply enlarge or reduce your view of the image by the specified percentage. The current magnification appears in the document window title bar.

Zoom In

View➢Zoom In [Numpad +]
Function: Enlarge the active image appearance in the window.
Description: This command increases the image magnification to next in the following sequence: 10, 25, 50, 100, 200, 400, 800, 1600 % of the actual image size beginning from the current image size.

Zoom Out

View➢Zoom Out [Numpad -]
Function: Reduce the active image appearance in the window.
Description: This command decreases the image magnification to next in the following sequence: 10, 25, 50, 100, 200, 400, 800, 1600 % of the actual image size beginning from the current.

Zoom 100%

View➢Zoom 100% [Numpad ₩]
Function: Display the active image at its original size.
Description: This command sets the active image magnification value to 100%, i.e. the window displays the image at its actual size.

Zoom

The Zoom popup menu contains commands that allow you to set the active image magnification to specified value.

Fit to Window

View➢ Fit to Window [Numpad *]
Function: Make the entire active image to be visible in the window.
Description: This command resizes the image window and sets the image magnification value so that the entire image is visible in the window.

Fit to Image

View➢ Fit to Image
Function: Resize the active image window to the image size.
Description: This command resizes the active window to the image size. You can use this command if the image occupies only a part of its window and you want to decrease the window dimension to the image one.

View type

View➢ View type
Function: Select the contents to be activated on a document window.
Description: This command allows you to activate contents such as images, measurement, statistics, charts, and manual measurement selectively.

Status Bar

View➢ Status Bar
Function: Show or hide the **Status Bar**.
Description: This command allows you to show or hide the **Status Bar**. The command menu item also has a checkmark while the **Status Bar** is shown.

Context window

View➢ Context window
Function: Show or hide the Context window.
Description: This command allows you to show or hide the Context window. The command menu item also has a checkmark while the Context window is shown.

ZoomIn window

View➢ ZoomIn window
Function: Show or hide the **ZoomIn** window
Description: This command allows you to show or hide the **ZoomIn** window. The command menu item also has a checkmark while the **ZoomIn** window is shown.

Window menu

The **Window** menu allows you to manipulate the opened windows: to cascade, tile, close them, move back and forth from window to window, and arrange icons on the bottom of the page. This menu also lists the names of the all opened windows. You can activate (move to front) a particular window by choosing the appropriate window name. The **Window** menu contains commands that allow you to split the active document windows into 2 or 4 parts in the horizontal or vertical directions, and merge the split windows.

Cascade

Window➢Cascade
Function: Overlap all opened windows.
Description: This command allows you to overlap all opened windows in the program main window so that each window is below and to the right of the previous one.

Tile Horizontal

Window➢Tile Horizontal
Function: Arrange all the opened windows as horizontal, non-overlapping tiles.
Description: This command allows you to arrange the opened windows so that they all take up equal space in the application window without overlapping. After this command is performed the windows are placed as horizontal tiles.

Tile Vertical

Window➢Tile Vertical
Function: Arrange all the opened windows as vertical, non-overlapping tiles.
Description: This command allows you to arrange the opened windows so that they all take up

equal space in the application window without overlapping. . After this command is performed the windows are placed in the program main window as vertical tiles.

Arrange Icons

Window➢Arrange Icons
Function: Arrange icons at the bottom of the program main window.
Description: This command allows you to arrange all the icons in a row at the bottom of the program main window.

Split Horizontal

Window➢Split Horizontal
Function: Split the active window into two parts horizontally.
Description: This command allows you to split the active window into 2 parts in the horizontal direction. When the window is split the **Window➢Split Horizontal** has a checkmark.

Split Vertical

Window➢Split Vertical
Function: Split the active window into two parts vertically.
Description: This command allows you to split the active window into two parts in the vertical direction. When the window is split the **Window➢Split Vertical** has a checkmark.

Close

Window➢Close [CTRL] + [F4]
Function: Close the active window.
Description: This command allows you to close the active window. When the window is closed, its associated document is closed too.

Close All

Window➢Close All
Function: Close all the opened windows.
Description: You can use this command to close all the opened windows at once. When a window is closed, its associated document is closed too.

Next

Window➢Next [F6]
Function: Activate the next window.
Description: You can use this command to activate the next opened window in the order, in which the opened windows are listed in the **Window** menu.

Previous

Window➢Previous [SHIFT] + [F6]
Function: Activate the previous window.
Description: You can use this command to activate the previous opened window in the order in which the opened windows are listed in the **Window** menu.

Help menu

Use the **Help** menu commands to access on-line help and to get information about the program and IMT.

About...

Help➢About...

Function: Display the program information.

Description: This command shows the **"About** program" dialog box that contains important information about the program, hardware key serial number, pertinent copyright information, and contact information of the program developer.

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Appendix A - GUARDANT ELECTRONIC KEYS. DIRECTION FOR USE.

Include this information in the installation instruction of the protected software!

General provisions

The electronic key is the device intended for the protection of programs and data from non-authorized using and duplicating. The electronic key is connected to parallel (LPT) or USB port of the computer. The electronic key for the LPT port, during normal functioning, does not handicap the work of the printer or other peripheral devices connected to it.

LPT port

1. Turn off the computer and peripheral devices connected to the parallel port (the printer, scanner, etc.). Disconnect the peripheral device from the parallel port. If the computer has several parallel ports, it is possible to connect the electronic key to any of them.

2. Plug in the electronic key to the parallel port of the computer (on the back panel of the system block), and then turn fixing screws by a screw-driver. Connection should be dense and without skews. It is possible to use cascaded electronic keys, i.e. they can be connected one to another consistently (up to 10 pieces). All of them will be accessible.

3. Connect the peripheral device to the electronic key and turn fixing screws with the screw-driver.

4. Turn on the computer and start the operating system.

USB port

Guardant USB electronic keys can be used in operating systems supporting the USB standard: MS Windows 95 OSR2/98SE/ME/2000/XP.

Connection and disconnection of Guardant USB keys can be provided while the computer is turned on or turned off.

Plug in the electronic key to the USB port of the computer

Running and storage regulations

- Protect the electronic key against mechanical influences (falling, concussions, vibrations, etc.), from influence of high and low temperatures, corrosive mediums, high voltage. All this can lead to its damage.

- Do not apply excessive efforts while connecting the electronic key to the computer and the peripheral device to the electronic key.

- Protect the electronic key (especially its plugs) against dust, dirt, moisture, etc. If the electronic key, especially its plugs, becomes greasy, clean them with a dry rag.

- Do not use organic solvents.

- Do not disassemble the electronic key. It can lead to its breakage.

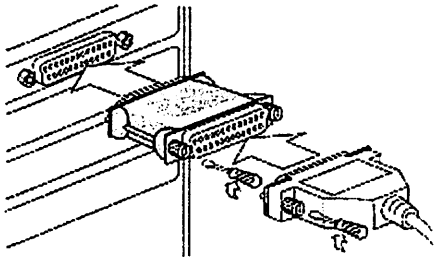
For LPT keys only

DO NOT connect the turned-on peripheral device to the electronic key connected to the computer. This can lead to breakage, not only of the electronic key, but also of the parallel port of the computer or peripheral device. Connection of the peripheral devices to the computer should be carried out only when the computer and the peripheral device are *turned off*, no matter the electronic key is connected to the computer or not. If the peripheral device is not used, it is possible to connect the electronic key to a working computer.

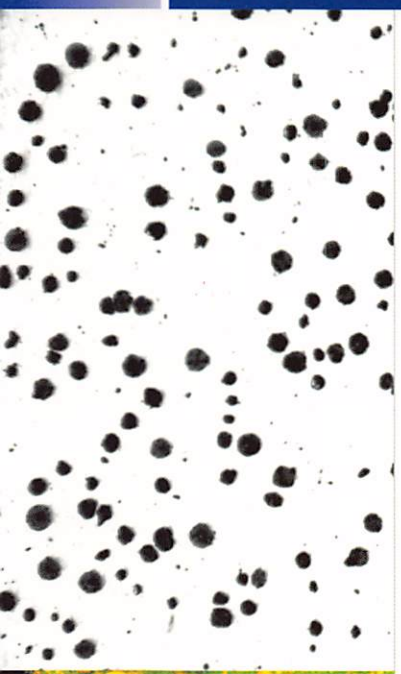
It is not recommended to reconnect the devices to the parallel port of the computer too often. It can lead to deterioration of the plugs and loss of contact.

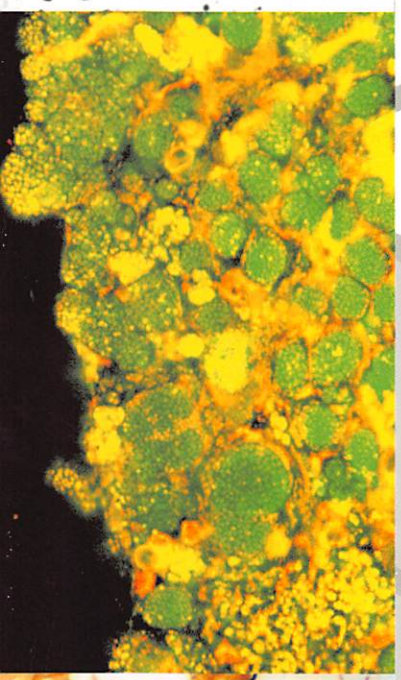
Use of cables and additional devices (auto and manual switches, etc.) that do not meet the requirements of the international standards for parallel interfaces (Centronics, Bitronics, IEEE 1284), can cause failures in work of any peripheral device, including the electronic keys connected to the parallel port.

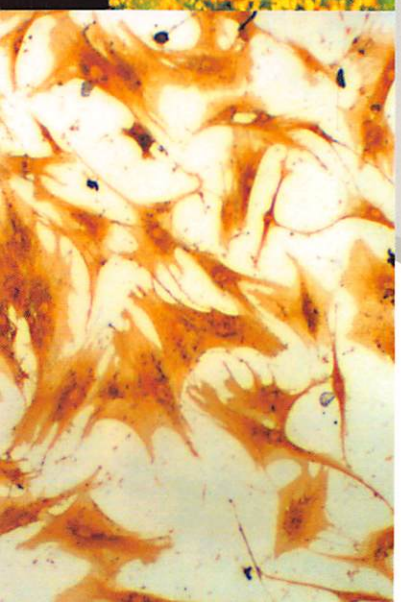
If the used devices and cables meet the standards mentioned above, normal work is guaranteed. The total length of interface cables should not be more than 1.8 m. Cables and devices should have the appropriate marking.



Thank you for using IMT i-Solution Inc. program!







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